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NEW YORK, SATURDAY, OCTOBER 14, 1899.


CONTENTS. PAGE.


Editorial ..... 565
Observations on the Operation of Wireless Telegraphy on La Grande Duchesse, by William Maver, Jr..... 563
Canadian Water Power Electrical Plants.—X; The Hull Electric Company and the Deschene Electric Company, by E. M. Archibald..... 569
The Street Railway System of Hanover, Germany, by Woolsey McA. Johnson ..... 572
Chicago Electric Railway Power Houses (with Insert)..... 574
Municipal Ownership at Austin, Tex., by W. D. Hornaday..... 575
Apparatus for Obtaining High Frequencies and Pressures, by Elihu Thomson..... 576
Illuminations at the Chicago Fall Festival, by S. S. Sherman..... 578
Seventy-fifth Anniversary of the Franklin Institute..... 579
Frequency Measurement ..... 581
Electrolysis from Electric Railway Currents..... 582
The Third Anniversary of the Metropolitan Street Railway Association of New York ..... 582
A German Electric Dray..... 583
Current News and Notes..... 583
LETTER TO THE EDITOR:
Deri Patent on Balancing Coils, by Max Deri..... 585
Digest of Current Electrical Literature, compiled by Carl Hering..... 585
New Books ..... 590
Prospective Exhibits at the Chicago Street Railway Convention..... 590
The Affairs of the Phœnix Battery Manufacturing Company..... 591
The Chicago & Milwaukee Railway System of Generation and Distribution ..... 591
Electrical Power in a Rubber Factory..... 592
Dynamo for Gas Engine Ignition..... 592
Fire Engine Searchlight Plant..... 593
United States Army Electric Wagons..... 593
NEWS OF THE WEEK..... 594


## THE RELATIVE ADVANTAGES OF DIRECT AND ALTERNATING CURRENT.

The battle between direct and alternating currents has now been waged for twenty years. At the present time it may not be said that either has conquered, but it is coming to be recognized that each has special advantages in particular departments of work, and that the question of relative advantages is only raised under occasional conditions that lie midway between their recognized spheres of influence. The direct current is almost exclusively used in incandescent lighting by isolated plants and in electric railway work. It is necessarily exclusively used in electrolytic work and in charging storage batteries. On the other hand, alternating currents are exclusively used in long-distance transmission of electric power. It is doubtful whether alternating currents would have come into their present widely extended use if the commutator of the direct-current machine could have been made a reliable apparatus at high electric pressures. It is the readiness with which high pressures can be generated, controlled and transformed that has given to alternating currents undisputed sway in the extended transmission of power.

The result of the combination of long-distance electric transmission with electric railway systems, or with already existing direct-current incandescent systems, has been to bring the converter into prominent use. Whatever may be said for purely experimental conditions, it seems necessary to employ mechanically rotating apparatus in order to transform alternating currents into direct currents. In other words, this transformation seems to be impracticable at the present time with any apparatus all of whose parts remain at rest with relation to each other. The amount of mass motion which is necessary in order to transform from alternating to direct currents is a question which admits of much discussion. We know that the mass to be rotated may consist of nothing more than a set of brushes around a commutator, the brushes being rotated by a small synchronous motor, and such apparatus on a comparatively small scale is in existence at the present time. The usual method, however, is to operate a converter, the weight of which is about half that of a generator of the power transformed. Each succeeding year makes improvements in the behavior of these machines, and they are now to be found in a large number of central stations. They have an efficiency which is only second to that of alternating current transformers, and are capable of considerable temporary overload. The only marked improvement that can be made in such machines in future is in the mass of the rotating part or in the transformation capacity per unit of mass employed.

One advantage of the alternating over the direct-current generator in large units, such as are employed for the transmission of large quantities of power, lies in the fact that alternators of high efficiency can be made which in the case of a short circuit will not strain the driving engines, but will only absorb a limited amount of power. This is accomplished by making the reactance of the armatures sufficiently great to check the current on short circuit; also, to give it a phase displacement that involves only a small power factor. In the case of direct-current generators, the same conditions can be brought about only by demagnetizing the machines by armature reaction, and it is very difficult to accomplish this in the case of well-de-

signed, self-regulating generators. Consequently, even if automatic circuit breakers are used with the generators, it is almost impossible to prevent momentary heavy stresses being brought to bear upon the machinery in case of an accidental short circuit; whereas, with alternators, automatic compensation is effected almost instantly.

The alternating-current induction motor also possesses certain marked advantages over its direct-current competitor in being devoid of a commutator and brushes. The commutator and brushes of a direct-current motor are always a source of difficulties and derangement, and these difficulties are only to be avoided by vigilance and care. The absence of the commutator in the induction motor and the simplicity of its revolving member, permits the machine to be placed in exposed situations out of reach and supervision where a direct-current motor could not be trusted. It is true that these advantages are offset to a considerable extent by the comparatively low power factor which induction motors possess. Nevertheless, we may expect that at some future time improvements in this field will enable the induction motor to be used with all of its advantages in evidence, and with none of its disadvantages apparent.

## ELECTRIC AUTOMOBILES.

Our contemporary, *The Horseless Age,* appears to consider that it holds a brief against the electric automobile. A few weeks ago we pointed out the worthlessness of some "evidence" it had offered in support of its position that "electricity cannot compete with horses in public cab service." The current issue of that journal contains another attack on electric automobiles, this time based specifically upon the assumed worthlessness of the storage battery upon which they depend for motive power. In this instance again, there is an extraordinary jumble of inaccuracy and misinformation. For example, an early experiment with storage battery traction is referred to as follows: "At Washington, D. C., *a few years ago* most extensive and disastrous experiments were conducted on the Metropolitan Street Railroad, ending in the usual way with the resumption of horse power." The italics are ours. For more than four years the road mentioned has been electrically equipped. The purely experimental Julien storage battery car run ten years or more ago in New York, is also referred to, but, of course, no mention is made of the Chicago & Englewood storage battery road which has been in successful operation for several years, nor of the successful storage battery lines in Paris and elsewhere abroad—foreign reference being confined to a single storage battery car said to be now running in England whose operation is stated to cost 36 cents per car-mile!

Among the specific charges against the storage battery are, that it has electrical and mechanical limitations; increased efficiency means greater weight and decrease in weight lessens the efficiency and weakens the plates; the sulphuric acid in the cells must be kept at a uniform specific gravity; too rapid charging and discharging results in damage; and so on in a vein that might be similarly worked in an arraignment of the steam engine or any of the imperfect product of the hand and mind of man. Again, we are told that the storage battery is a delicate subject even in stationary work, and that for cab and delivery service it is as often in the hospital as it is in service—for which reckless statement no proof is offered; that in traversing roads that are rough and intersected by street car tracks, the whole overloaded structure is racked, gears are thrown out of line, wheels are strained and the power of the battery wasted. Strangely, there are a few words of favor for the electric automobile, it being said that its high cost, simplicity of control and undeniable æsthetic features, commend it to the rich, especially to ladies, for urban use, and that it will undoubtedly find other incidental uses where the demands made upon it are light. Some may question the ethics of selecting ladies and the rich to be the victims of such an abomination as the electric automobile is portrayed.

As our contemporary does not assume to have any technical knowledge of the storage battery, and apparently quotes merely at random in its phrases of condemnation, the technical argument advanced cannot be taken seriously. The more general charge concerning the limitations of the storage battery due to its very nature, may, however, be noticed. As to these limitations, none probably is more aware of them than advocates of the electric vehicle. But their point of view is that if the limitations do not apply to its profitable use in such work, they have not much more than academic interest—a stand, it may be remarked, which does not differ from that taken with respect to any other matter in this world. That the storage battery can be profitably applied to electric automobiles is no longer an open question in view of the already extended commercial experience had with it. The matter is thus essentially a commercial one, and is not affected by arguments based upon limitations of the storage battery. That the battery is more delicate that the generator of a steam automobile is a matter of indifference, if it commercially answers the purposes for which it is used. The position of our contemporary is, in fact, what might have been the position of the clock trade had the watch been suddenly introduced and considered to menace the clock industry. Experience long since would have shown that the more delicate nature of the watch mechanism could not militate against its use, any more than such arguments as our contemporary offers can influence adversely the employment of the storage battery for automobile work. During the past six months the demand for electric automobiles in this country would, we are in a position to state, have required 40,000 vehicles to satisfy it. Such a condition as this implies should warn our contemporary that, unless it recognizes the absurdity of its attitude, it may soon be an anachronism in a horseless age.

## FREQUENCY METERS.

One of the most vital characteristics of alternating current machinery, viz., the frequency, is never made the subject of indication by means of a meter, as are the voltage and the ampere output. There seems to be in practical work but little demand for anything in the nature of a frequency meter outside of the everyday synchronizing devices, which are differential frequency indicators. The reasons are not difficult to find. The frequency meter is nothing more nor less than a speed indicator of the alternating current generator, or, more properly, a tachometer; and as such indicates only the action of the governor. Since the whole purpose of the governor is to maintain the speed and thereby the voltage constant, any derangement which would seriously interfere with its purpose would be instantly indicated by the voltmeter, rendering a frequency meter or other speed indicating device unnecessary. While tachometers are frequently employed, particularly abroad, their use is more a refinement than a necessity, since governors, as a rule, when they become deranged at all, break down entirely, and their failure becomes instantly apparent in more ways than one.

If, however, a simple frequency meter with an indicating needle or other device direct reading on a scale of cycles per second could be devised, it would probably be much more popular than is the tachometer, as it would permit the speed to be indicated by an instrument upon the switchboard and directly under the eye of the attendant, instead of located upon the machine and away from other instruments with which it may be desired to compare its indications. The prospects of the appearance of a practicable instrument of this kind would appear to be slight, the various principles upon which such a device could be based being non-applicable to a direct-reading instrument. For example, one of the most successful arrangements

for this purpose in laboratory work consists of a wire vibrated by the reaction of the alternating current within it upon the magnetic field around it, the frequency of the vibration being determined either by tuning forks or by calculation from a formula involving the length, tension and weight of the wire. Such an instrument was described in these columns some time since, and there appears on another page of this paper a reprint of a paper read some ten years ago, in which the same instrument was described.

Of course, the adjustment of the length of the wire to give synchronism between the free and forced vibrations, and the reading of the instrument by means of tuning forks, are features that prohibit its adoption for switchboard work. Similar impediments stand in the way of the adaptation of various other combinations employed in scientific work, such as vibrating steel reeds set in motion by alternating current magnets; while the dependence of the indication upon the voltage bars another class of devices, such, for example, as hot-wire indicators, based upon the hysteresis effect. There appears to be no phenomenon of alternating currents on which a meter for this purpose can be based not subject to one of the other of these two objections.

## Constant-Current Transformers.

It is a curious fact that constant-current series-transformers, and constant-potential parallel-transformers present but little difficulty to the designer. But constant-current transformers in parallel, or constant-potential transformers in series, present difficulties that seem to require special apparatus to avoid. The constant-current transformers exhibited at the recent meeting of the American Institute of Electrical Engineers, showed how one of these difficulties can be overcome by balancing the secondary coils and employing the repulsive electromagnetic force exerted between primary and secondary currents to bring about automatic regulation of current strength in the secondary circuit. These transformers may be said, in fact, to be electrodynamometers and transformers combined.

One peculiarity of the behavior of these machines was brought out in the discussion; namely, that the wave forms of e. m. f. and current varied considerably with the load. Mr. Steinmetz showed, in a very interesting way, how this is accounted for by the fact that the resistance of the alternating-current arc is a variable quantity during the cycle, being relatively large when the current is small and *vice versâ*. The result of this is that when the primary and secondary coils are widely separated from each other, the primary circuit has less control over the wave form of currents in the secondary circuit than when the primary and secondary currents are close together. It would seem as though this remarkable variation might be susceptible of some practical utilization, but at the present time there seems to be no application of it.

## Electric Railway Growth.

The capital liabilities of the street railway systems of the United States are at this moment not far short of $1,750,000,000. The figure at the close of 1898 was over $1,600,000,000, and the gain each year is about $175,000,000. This stupendous development is due entirely to electricity. All the king's horses and all the king's cables could never have effected such a growth as the street railway industry has seen since Van Depoele, Sprague and Henry and others threw their energies and inventive ability upon it ten or twelve years ago.

The development has been peculiarly American. Why, nobody can explain, but the fact remains and is best illustrated by the manner in which American practice is being copied the world over. And not only is the practice copied, but American apparatus for trolley systems is being shipped to every quarter of the globe. A great new department of export trade has thus been built up which bids fair to remain one of the best and biggest outlets for American manufactures.

The large gathering of street railway men at Chicago next week will be but another evidence of the importance of their industry and its intimate relation with all that is most hopeful in national progress. The earnings of the steam railroads of the country from passenger traffic are put at $272,000,000. It is putting it not far from the mark to say that the street railways earned above $175,000,000, and thus carried about five thousand million passengers, or ten times as many as the steam roads. And when, under the irresistible influence of the example set by the street railways, the steam roads become electrified, how the figures of travel will once more jump up by millions upon millions. That is the great change now impending, as the inevitable result of the last ten years' work on the street railways of America.

It would seem that so far as practice goes, most of the apparatus for the existing methods had been hammered out to a standard. So far as the apparatus is standardized, it is a gain in which everybody shares, but the standard itself becomes the point of a new departure. Certainly we can at present see no finality to the improvements being made in electric railway work, improvements in the promotion of which the meetings of the American Street Railway Association have been a most helpful agency.

## Obstacles to the Electrical Industry in England.

That those who would advance the electrical industry in England are met with all manner of obstacles not encountered in this country, is pretty well known. What with the delay and expense in Parliamentary procedure to obtain permission to invest their money, with harsh conditions imposed by municipalities and subjection to a Board of Trade, electric lighting and traction has a hard time of it in Great Britain. It appears, however, that governmental obstacles are not the only ones that are interposed. One of our English contemporaries refers to an "ignorant and purblind outcry" raised in the non-technical press against the action of electrical companies in raising central station voltage. It appears that in London there is much newspaper opposition to raising the pressure from 100 to 200 volts, notwithstanding that the supply companies give new lamps for the old ones of lower voltage and make a reduction in the price of current. No arguments relating to any greater danger or inconvenience of the higher voltage are adduced, the unreasonable stand being taken that the higher voltage is greatly to the benefit of the supply company, and should therefore be opposed. Did such a spirit exist in this country, instead of three thousand central stations, we would probably only have as many hundred.

## Testing the Wireless.

Some very interesting testimony as to the value of the wireless telegraph is given in our columns this week by Mr. W. Maver, Jr., who has availed himself of the opportunity afforded by the yacht races to make a study of its workings on board one of the steamers chartered to receive and send wireless telegraph despatches. Mr. Maver's high standing as a telegraph expert gives weight to his observations. It is encouraging to note his belief that while a speed of 12 to 18 or even 22 words has already been attained, not less than 30 or 40 may be expected in the near future. In common with all who have witnessed the work, Mr. Maver pays the tribute of warm admiration to the skill and success of Mr. Marconi in overcoming so many difficulties and in reducing the necessary mechanism to apparatus so simple and reliable as that used.

## Observations on the Operation of Wireless Telegraphy on La Grande Duchesse.

By William Maver, Jr.

If it were possible, an additional interest was lent to the present series of international yacht races between the Columbia and Shamrock by the announcement that the progress and result of the races would be reported by wireless telegraphy. Before the coming of Mr. Marconi to this country, the *New York Herald* had arranged with Mr. W. J. Clarke, the well-known maker of wireless telegraph instruments in this country, to undertake this work. Having for the past two years been associated at intervals in an advisory way with Mr. Clarke, an opportunity was afforded the writer to note the operation of wireless telegraphy on La Grande Duchesse, which accompanied the racers, on which steamship a set of Mr. Clarke's apparatus was installed, and it is thought that some details and general observations concerning the work may be of interest.

During the first week of the races, Mr. Marconi was on the steamship Ponce, another of the numerous vessels which accompanied the yachts, in charge of his apparatus. There were also stations equipped with his apparatus on the Mackay-Bennett cable ship and at the Navesink Highlands. The cable ship was stationary, near the starting point of the races, about six miles from the Highlands.

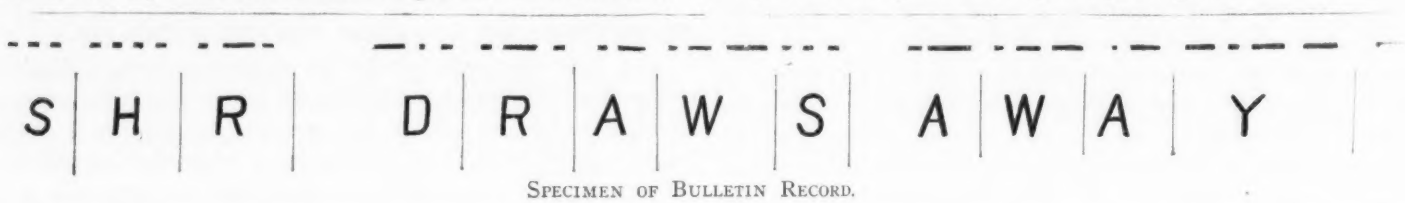
As Mr. Marconi was also retained by the *New York Herald*, all the apparatus was under one control, and arrangements were easily made whereby interference between the respective stations would be avoided.

Inasmuch as the code employed by Mr. Marconi is the Continental or Universal, in which code Mr. Clarke is not proficient, one of Mr. Marconi's clever assistants, Mr. Rickard, was delegated to transmit the bulletins from La Grande Duchesse.

On the first day of the race it was arranged that the transmission of bulletins from the respective ships, namely, the Ponce and La Grande Duchesse, would be controlled by flag signals from the Ponce, but owing to the forest of masts, sails, etc., of the excursion boats that intervened, the vessels frequently lost sight of each other, being at times several miles apart, and rather than run the danger of setting up interfering signals, the representative of the *Herald* refrained from sending any bulletins on that day. It was, however, quite apparent on board La Grande Duchesse that the progress of the race was being duly reported by the Ponce, inasmuch as the bulletins from that vessel were being recorded on the tape of Mr. Clarke's recording instrument.

On the day of the next race, or attempted race, namely, Thursday, the 5th inst., it was arranged that bulletins from the Ponce and La Grande Duchesse should be sent alternately at specified times, a plan which worked admirably, and was followed Saturday.

An interesting incident occurred on Saturday. The progress of the race had been reported from La Grande Duchesse between the hour of 12:30 and 1:30 p. m., at which latter time the yachts were nearing the turning stake, fifteen miles from the starting point. The signaling was then taken up, according to agreement, by the Ponce, and the vertical wire was disconnected and removed some distance from Mr. Clarke's receiving apparatus. In the efforts of the captains of the various vessels to give their passengers a favorable view of the turn, the Ponce and La Grande Duchesse came within 100 yards of each other, and presently the coherer of Mr. Clarke's instrument began to respond to the signals being transmitted from the Ponce to the cable ship or mainland, notwithstanding, as just stated, that the vertical wire was totally disconnected from the receiving apparatus. Mr. Rickard thereupon connected the vertical wire to the receiving apparatus, when the signals were at once seen to be too powerful. Mr. Rickard then interposed his body as a rheostat between the vertical wire, which sufficiently reduced the strength of the electric oscillations. Wishing to read the incoming signals, at which he is an adept, Mr. Rickard delegated the office of rheostat to the writer, who held it until Mr. Clarke's foreman could procure a dampened piece of string about six inches in length, which thereafter served in the desired capacity until the ships had separated to a greater distance, when the vertical wire was again connected directly to the receiving apparatus. A specimen of the bulletins as recorded at this time by Mr. Clarke's apparatus is shown. The corresponding letters are placed under the dots and dashes. For the sake of clearness the letters of the code are here separated by a vertical line.




Specimen of Bulletin Record.

Some of the foregoing recorded signals which the writer has had time to translate were somewhat indistinct, but most of them were readily decipherable and portions were as clearly recorded as if the work had been done upon a regular telegraph wire. In view of the fact that for this particular service no preliminary tests of Mr. Clarke's apparatus on La Grande Duchess could well be made, this result is not only creditable to him but is also significant of a degree of simplicity of operation of wireless telegraphy, at least for moderate distances, that was perhaps not generally anticipated.

The speed of signaling thus far reached by Mr. Marconi and his assistants, as judged from the writer's observations, is between 12 and 18 words per minute. It is, however, stated that a speed of about 22 words has already been attained. It would not, however, surprise the writer if the speed ultimately attained by expert senders on this system should reach 30 to 40 words per minute. Doubtless the former speed at least, will be reached shortly.

The writer observed while deciphering the bulletins recorded in duplicate or triplicate by the apparatus of Mr. Clarke's construction on La Grande Duchesse, that Mr. Marconi and his assistants have already reached a degree of expertness in sending and receiving where they can venture to abbreviate. Thus, Col. or Clmba. for Columbia; Shr. for Shamrock; abt. for about; bd. for board, etc., are employed. While such abbreviations render the translation somewhat more difficult to one not thoroughly familiar with the code, their use certainly indicates a marked confidence in the efficiency of the system on the part of the experts operating it.

The ink recorder used by Mr. Marconi is of the Wheatstone or Siemens general pattern; that employed by Mr. Clarke is a modified form of the inking registers used to record the calls in the District Telegraph service. It is, of course, understood that the ink recorder is operated, in common with the "tapper" by a relay which, in turn, is operated by variations in the resistance of the coherer. It may be noted that while the recorder is used almost exclusively for the reception of messages, the expert operators of the system are able to read by sound caused by the tapper, or decoherer.

The tests thus far made and the actual work done by Mr. Marconi have demonstrated the practicability of wireless telegraphy. The degree of success which he has reached in the comparatively short time during which he has been experimenting with this system, both as regards the distance to which signals can be transmitted (now over 100 miles) and the rate of transmission, is remarkable. To make such progress it is evident that ability of a high order must have been available, together with the wherewithal necessary to procure whatever the judgment of the experimenter deemed essential to success. It is evident that these essentials were at Mr. Marconi's command, the former doubtless in his own person.

At present it is assumed that the utility of wireless telegraphy is limited by the fact that but one transmitter can be operated in the same neighborhood. This, however, would not be a serious detriment to the system as a whole, since it is probable that the greatest general utility of the system may prove to be in places where such interference will be unlikely, or can be avoided by a simple prearrangement. Even this limitation, however, may be in a large measure disposed of when existing or further inventions shall make it possible to direct and screen electric waves in a manner analogous to that in which light waves are now directed and screened, and to tune the respective transmitters and receivers to synchronism analogously as tuning forks are now attuned to sound waves; a refinement of the art of wireless telegraphy which the advance thus far made, fully warrants us in anticipating, at least to a certain degree of practicability. In fact it is intimated that Mr. Marconi has already had success in these directions.

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## Canadian Water Power Electrical Plants—X.

THE HULL ELECTRIC COMPANY AND THE DESCHENE ELECTRIC COMPANY.

By E. M. Archibald.

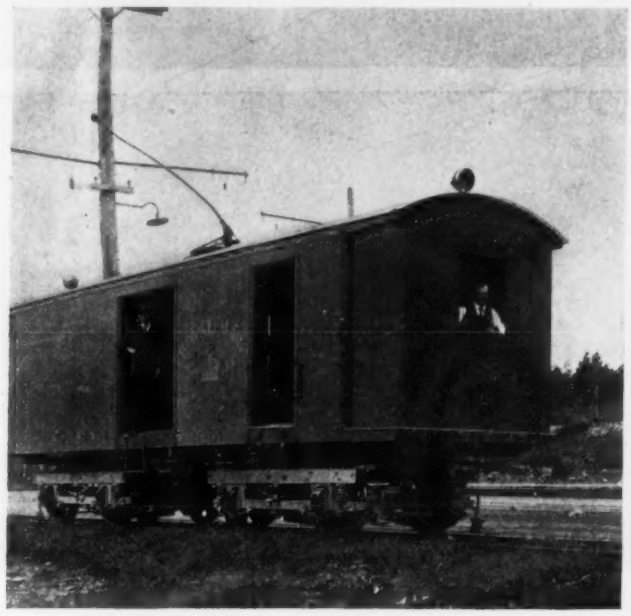
THE above are the names of two separate electrical companies, the former operating a street and suburban railway as well as an electric lighting plant, lighting the City of Hull and town of Aylmer, Quebec; the latter distributing electrical energy for lighting and power purposes in the City of Ottawa. Though separate, they are under the same management and have practically the same directors.

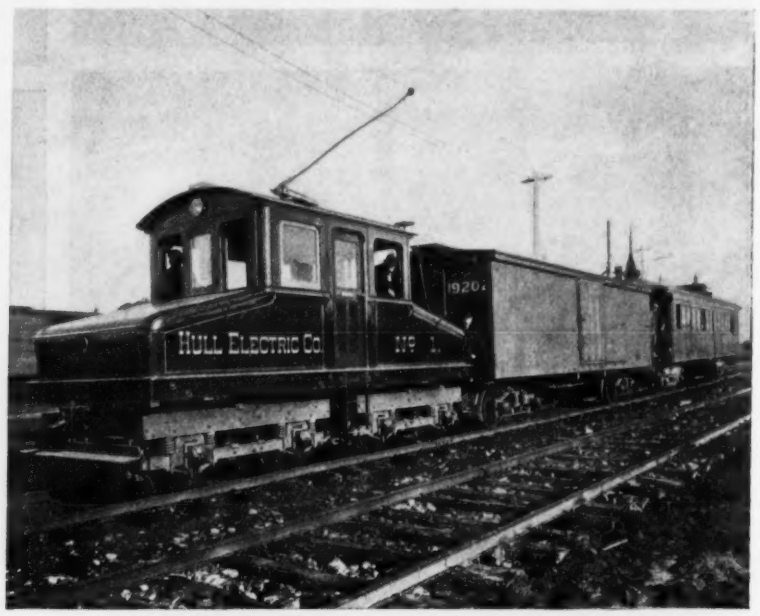
The Hull Electric Company operates a street railway in Hull, a city of some 15,000 inhabitants, situated directly across the river from Ottawa, the capital of Canada; and also a suburban line from Hull to Aylmer, a small town of 2500 inhabitants, a distance of 10 miles. The power house is situated at the Deschenes Rapids on the Ottawa River, some 7 miles above Hull, and here sufficient power is generated for the whole line, besides operating three machines for the Deschene Electric Company.

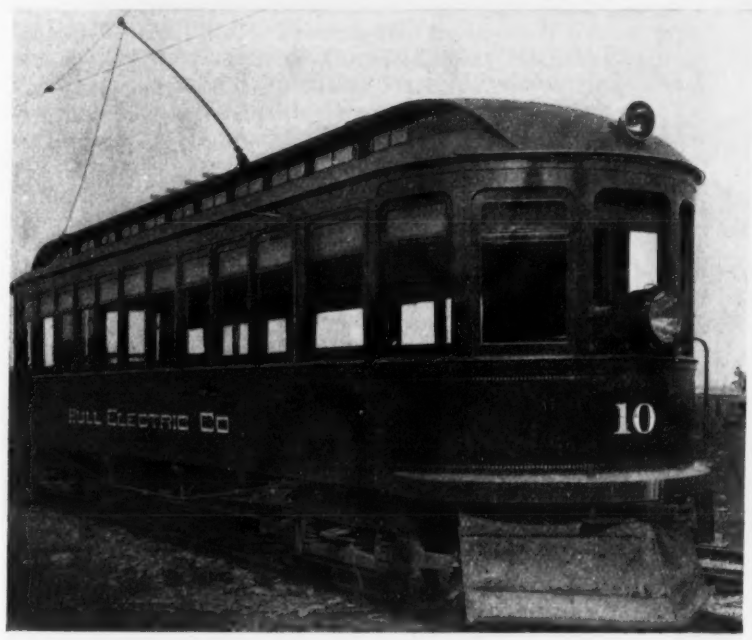
About 35 miles above Hull, the Ottawa River expands and forms what is known as Lake Deschene, a broad expanse of water, 27 miles long, from 3 to 7 miles wide and quite deep. At the lower end of the lake the rapids are situated, a seething and foaming turmoil of waters, extending from shore to shore, from the Quebec to the Ontario side of the river. The rapids are quite flat, the total fall being only 10 feet at low water in the whole 2000 feet of their length.

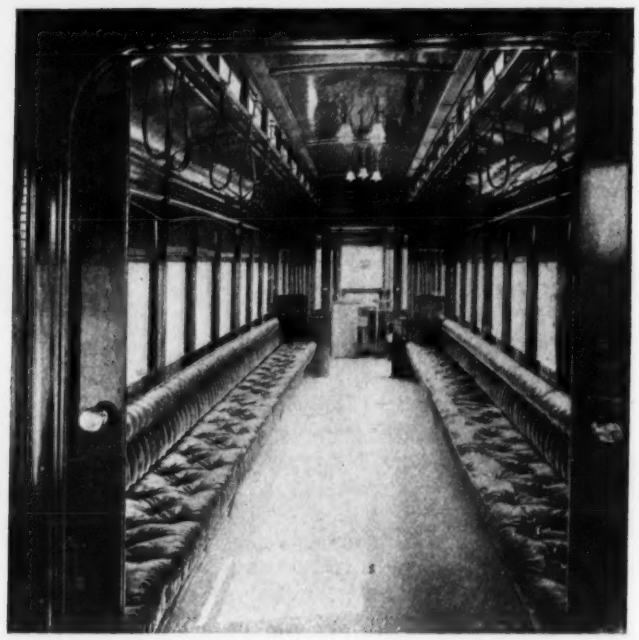
On the Quebec side of the river, at the very head of the rapids, there is situated a narrow island, extending down stream parallel to the shore and distant from it about 500 feet. A better location for a head race and a power house could scarcely be desired. Very little excavation was necessary, and now there stands a head race 1000 feet long and 500 feet wide, in which the water has so great a volume as to be practically still, and is at a level with the one above. The narrow island has been altered somewhat, a heavy cribwork dam being erected where the shores were too low and at the entrance a wing dam, also of cribwork, filled with rock, running 60 feet obliquely into the lake, has been constructed to prevent the slightest possibility of any frazil ice entering the head race from the rapids.

The question of frazil and anchor ice, those bugbears to Canadian water power development, seems to be settled here beyond all doubt. As neither frazil nor anchor ice can form under cover of surface ice, but only in rapids, where the former assumes the form of long needle-like crystals, and as the whole of Lake Deschene and the head race are completely frozen over in winter, practically no current existing there to hinder ice formation, there is no possibility of frazil or anchor ice forming. Frazil does form in the rapids outside, but the construction of the wing dam at the head prevents any from entering the head race.

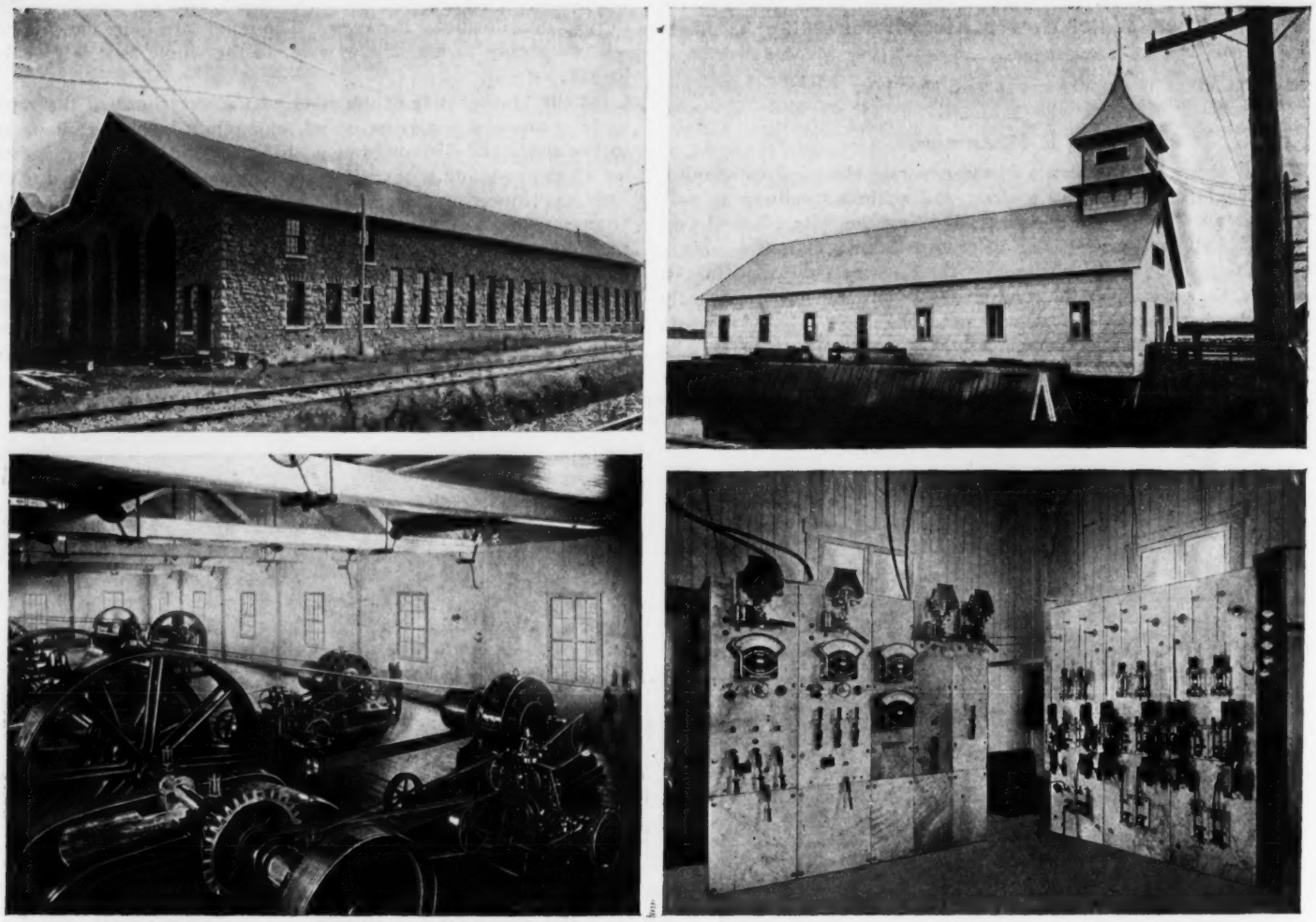




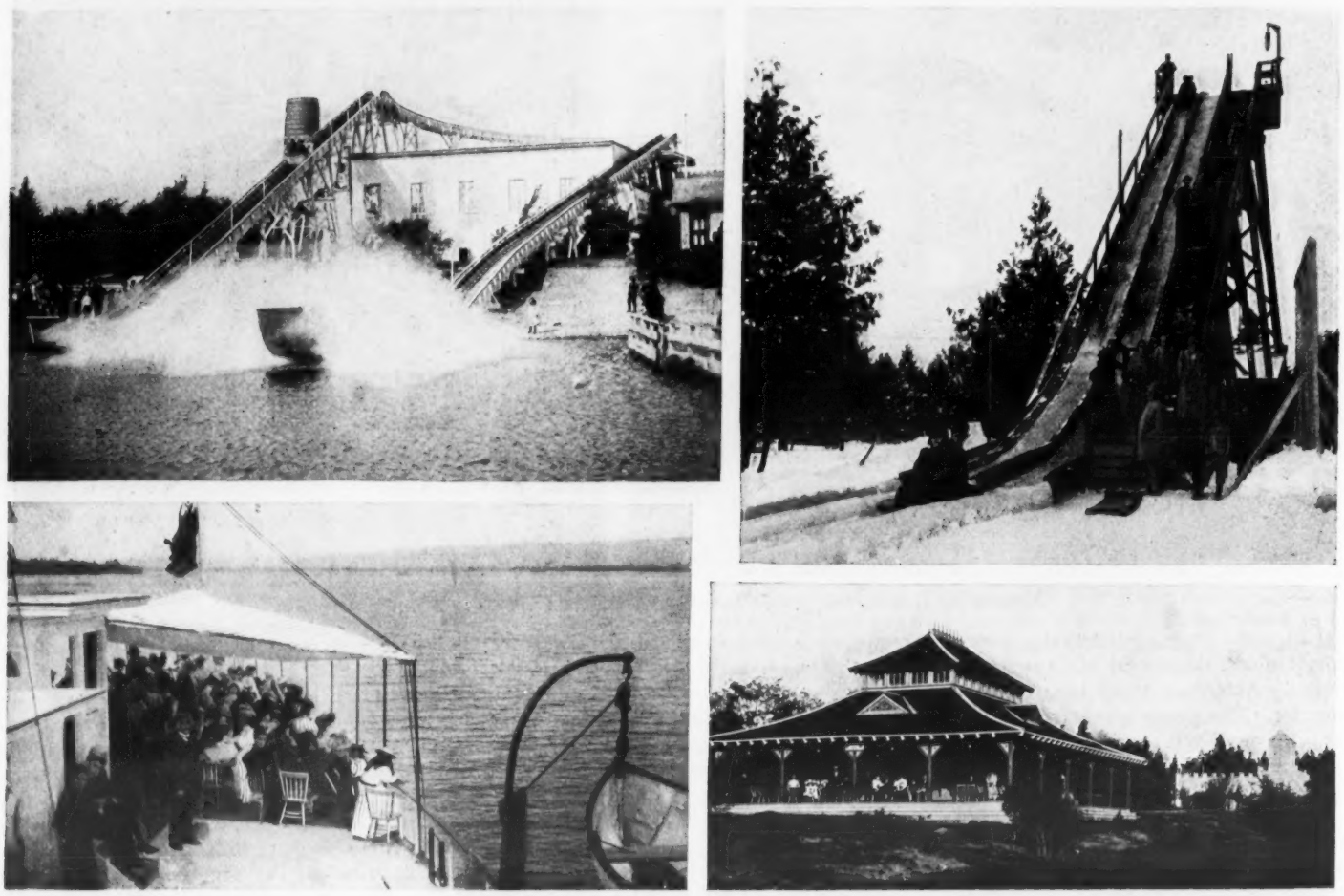



Mail Car, Locomotive and Passenger Car, The Hull Electric Company.



POWER HOUSE, INTERIOR AND CAR BARN, HULL ELECTRIC COMPANY.



AYLMER PARK ATTRACTIONS AND STEAMER.

The tail race is the Ottawa River, the water returning to its original course.

POWER HOUSE

The power house situated on the island above mentioned, at the termination and on one side of the head race, is a one-story timber structure encased in galvanized iron sheeting. Water enters the wheel pits perpendicular to the direction of flow through wooden racks, thus preventing any floating ice or rubbish which may have escaped the booms placed in the head race, from entering and injuring the wheels. Head gates may be lowered in a narrow portion of the head race, thus stopping all flow of water.

From the six 60-inch "New American" vertical turbines built by Wm. Kennedy & Sons, Owen Sound, Ont., developing 170-hp each, under the normal head of 9 feet 6 inches, power is transmitted to a jack shaft running at 165 r. p. m. by heavy mortise bevel-gearing.

THE DESCHENE COMPANY'S ELECTRICAL EQUIPMENT

From pulleys on this jack shaft there are belted three 150-kw 2000-volt monocyclic alternators, generating current at a frequency of 60 cycles per second. Three 125-volt 3-kw exciters are belted to pulleys on the shafts of their respective alternators, for exciting the fields.

The exciters, monocyclic alternators and all the electrical apparatus, were manufactured and installed by the Canadian General Electric Company, of Peterboro, Ont.

Water wheel speed regulation is performed by a "Replogle" mechanical governor belted to the jack shaft, raising or lowering the cylindrical wheel gates as required by means of friction clutches and gearing.

The switchboard consists of four white marble panels mounted on an angle-iron frame constituting a thoroughly fireproof board.

Here are situated the usual switchboard instruments, main triple-pole switches, field and exciter switches and rheostats and the synchronizing lamps, coupling the alternators in parallel, being performed when the lamp is dark. On the face of the board and placed at the top are enclosed fuses in every feeder.

POLE LINE

The Deschene Electric Company, though operating under a Dominion Government charter, has not yet been able to obtain a city by-law permitting it to enter within the limits of Ottawa, erect its poles and string its wires. Until this by-law has passed the city council, the business is necessarily small, and whereas the transmission line was designed for 5000 volts, the present pressure is only the 2000 direct from the machines, rendering the use of step-up and step-down transformers unnecessary.

This pole line is 8 miles long and consists of six No. 0 medium drawn bare copper wires on a single cross-arm, 15 inches apart, securely fastened each to a Boch glaze-filled porcelain triple-petticoat insulator tested to 20,000 volts and manufactured by the R. Thomas & Sons Company.

The poles are of white cedar, varying from 30 to 60 feet in height, 8 inches in diameter at the top; set from 5 to 7 feet in the ground and spaced 90 feet apart.

Protection from lightning is afforded by Wirt short-gap lightning arresters situated at three separate points along the line, each having two gaps between each line and ground, that being sufficient for the pressure of 2000 volts as used at present. The line loss is 10 per cent. at full load with a tension of 5000 volts.

A line is conducted into Ottawa by crossing the Ottawa River by submarine cables, passing through government property and thence reaching the two buildings—the Russell House and the Theatre—to be supplied with both light and power; the hotel elevators are operated by hydraulic power, water being pumped by means of three-phase induction motor-driven pumps.

The submarine cables above mentioned are two in number, each 2100 feet in length, consisting of three No. 0 copper wires encased in iron armor and manufactured by the National Conduit & Cable Company.

HULL ELECTRIC COMPANY'S ELECTRICAL EQUIPMENT

Two 6-pole 325-kw Canadian General Electric compound railway generators are belted to pulleys on the jack shaft in the power house.

These machines are operated at their total capacity at all times, an artificial load, consisting of six large rheostats placed in a small annex in summer and under the power house floor in winter for heating purposes, being thrown on or off by a simple method, designed by Mr. J. E. Brown, the electrical engineer and superintendent; when a spring of a certain tension overcomes a solenoid, the voltage being then low, a portion of the artificial load is thrown off, the arc hissing and flaming from the carbon contacts. This method was adopted on account of the water wheel governors being utterly unable to cope with the greatly varying fluctuations of load.

Circuit breakers are placed in every feeder at the top of the five-panel white marble switchboard containing the artificial load apparatus.

There are two limestone car houses, each 150 feet long by 70 feet wide, and one story high, and each containing two tracks and pits, besides a machine shop, tool and store rooms, draughting room and office.

ROADBED AND ROLLING STOCK

The whole suburban line is double tracked with 56-pound T-rails well bonded. Including the small amount of track for the city service in Hull, there are 26 miles of track. The road is well ballasted with broken rock, and the rails bolted to cedar ties, numbering 2640 to the mile.

This suburban line lies along the bank of the Ottawa River almost on a perfect level, the heaviest grade being about 3 per cent. With the cars speeding along at 30 miles an hour, with no perceptible side motion a pleasant feeling of exhilaration comes over one, and the 11 miles pass all too quickly.

For passenger traffic there are fourteen double-truck motor cars, five of which are closed and nine open, the closed cars being vestibuled at both ends and beautifully finished in mahogany and plush upholstering.

In the vestibuled compartment at each end of the closed cars there is an observatory and smoking room. These cars were all built at the Canadian General Electric Company's shops, at Peterboro, Ont., and are each equipped with four motors, geared to 30 miles an hour; the double trucks used are of the Blackwell, Taylor and Brill makes. All the closed cars are heated electrically by eight heaters.

There are also two 21-feet single-truck cars for city service and four thirteen-bench trailers for heavy traffic on the suburban line.

Freight is also carried on this road, connecting with a steam railroad above Aylmer, and for this purpose there are two electric locomotives and an express and mail car, this latter being mounted on a double truck equipped with two G. E.-1200 motors. Of the locomotives, No. 1 is 22 feet 8 inches long, mounted on a Blackwell truck and equipped with four motors, geared to 20 miles an hour, hauling usually 5 to 6 loaded freight cars. No. 2, the larger, is mounted on McGuire "L" trucks and is 26 feet long, equipped with four G. E.-51 motors capable of developing 80-hp each; these are also fitted with standard air brakes and haul as many as 12 loaded freight cars.

For clearing the tracks of snow in winter, there are two snow plows, a Ruggles rotary and a C. G. E. ordinary sweeper, besides which, attached to both ends of all the closed cars, are snow plows in the shape of a covered locomotive pilot.

All the locomotives with their equipment were built by the Canadian General Electric Company, Peterboro, Ont.

SPECIAL ATTRACTIONS

At the termination of the suburban line is situated the Queens Park, a beautiful piece of land, widely diversified as to woodland, beach and open ground. It is 200 acres in extent, and borders on Lake Deschene, which produces excellent boating and bathing. These features together with the attractions of a casino, a maze, a water toboggan, merry-go-rounds, etc., built by this company and operated by electric motors, never fail to draw people from the hot city to the cool and refreshing breezes of the country as typified in this park. During the summer months, an elegant steel steamer is chartered to run excursions twice-a-week from the Queen's Park pier to the Chats Rapids, about 25 miles distant. The scenery is grand, especially at "the Chats," and the trip has a special interest in that it covers part of the route of the proposed Ottawa & Georgian Bay Canal.

An interesting feature in connection with the passenger traffic of the Hull Electric Company is that as far as possible only metal tickets are used. These are made of different shapes and combinations of metals to represent the different values of the tickets. Our acknowledgments are due to Mr. W. R. Taylor, secretary of the Hull Electric Company, for valuable assistance in the preparation of the above article.

# The Street Railway System of Hanover, Germany.

BY WOOLSEY MCA. JOHNSON.

THE street railway system of Hanover, Germany, presents several features which are somewhat different from the usual American practice.

I.—In the centre of the city the cars are propelled by storage batteries placed under the floor. When the cars have reached the suburbs, the power is derived from overhead wires, charging the accumulators as well as running the motors. On one short urban line, however, the accumulators are charged while the cars stand in the power house.

II.—The current for the motors and also for the batteries is transferred from the overhead wires by a horizontal aluminum bar, is carried at right angles to the overhead wires.

III.—There are six central stations, situated at different points of the road. The power for the outlying sections of the road is transmitted from one of these central stations as high-tension, three-phase, alternating currents, to such stations where it is charged to the low tension, direct current by means of rotary converters.

The company furnishes also light and power to many of the small manufacturing towns and villages in the neighborhood of the city. In Hanover proper there is a municipal electric plant. The system used is high-tension three-phase transmission, with static transformers.

The whole system, light, power and traction, was laid out with care and foresight to meet the existing conditions. Its inception was due to Herr Th. Krüger, director of the company, who called to his assistance Herr Clemens Adam and Herr W. Jürges as head engineers in the construction of the road. The present engineers are Herr Dr. Haas and Herr Grotewold.

The company at the end of the year 1898 operated 120 miles (204 km.) of single track. About 6.6 miles (11 km.) are laid with iron cross ties. There were also then in construction some 31 miles (52 km.) of new track. The company had at the end of 1898 212 motor cars, of which 36 were without accumulators, 169 trailers, and 106 baggage and freight cars of all descriptions. There were then building 32 motor cars with accumulators, of which 20 were locomotives with two 25 and 50-hp Westinghouse motors; 140 baggage and freight cars, and 63 trailers.

The batteries in the cars consist each of 200 cells of the Tudor type, made by the Akkumulatorufabick-Aktiengesellschaft, of Hagen and Berlin. The cost of the maintenance of the battery of a car of the mixed system was about .4 of a cent a car-mile. In the purely storage battery system of the road the cost was .9 of a cent per car-mile.

The mixed system has many of the advantages of the accumulator system of traction as well as extreme simplicity. However, there are all the disadvantages inherent in such a system as well as the further disadvantage that the "trolley cars"—the old name is still preserved—are burdened with a heavy load of accumulators, which must be carried in some cases over 30 miles on a single round trip. The country in the vicinity of Hanover is extremely flat, and the steepest grades are those caused by bridges over the steam railway tracks. This, of course, is a tremendous factor in keeping down the cost of traction.

The contact with the overhead wire or wires—in most of the lines there are two parallel wires about six inches apart—is made, as has been stated, in a rather unusual manner. The motor cars have generally two trolleys—in some cases only one—that resemble inverted deltas with a prolonged vertex. The inverted bases are aluminum bars, slightly curved, about 4 feet long, 3 inches wide and and ⅝ of an inch thick. The plane of the frames forms an angle of about 25 degrees with the vertical. The bars are held in contact with the overhead wire by an arrangement of springs, as can be seen in the accompanying cut. When the end of the route is reached and the car is reversed, the motion of the car turns both frames, which are pivoted together in the centre, pushing up the overhead wires about a foot.

The advantages claimed for this system are: (1) That there are four points of contact instead of one; (2) that the aluminum bars last longer and are simpler than the trolley wheel; (3) that there is no "slipping of the trolley." On the other hand (1) the wheel has a larger surface of contact; (2) there must be more abrasion of the overhead wires with this device than with the trolley wheel, because the contact is a sliding contact and not a rolling contact as is the case with the trolley wheel; (3) the overhead wires are necessarily subject to a strain when the car is reversed and the bars raise the wires. The power for the system is generated at six central stations, situated at different points on the line. Four of these stations also generate power for commercial lighting and power purposes.

The central station at Glocksee furnishes current for the road in the city of Hanover, and also for the shops of the company at Glocksee. It has four Siemens & Halske direct-current generators of 165-kw each, one of 300-kw, and one of 435-kw, all giving a voltage of 500 to 550. For the machine shop motors, for the storage battery and for lighting there are two motor-generators (gleichstrom-uniformer), which reduce this voltage to 110. The storage battery consists of 180 cells of the Tudor type, 250 ampere-hours' capacity, with a charging rate of 64 amperes and a discharge rate of 83 amperes. The battery is charged by the motor generators, and can be discharged in three parallel rows. The feed wires for the overhead system are carried in iron-bound lead cables, laid in brick conduits. The return is through the rails. Near this central station, however, a heavily turned copper conductor is laid between the rails. The second central station is situated at Vahrenwald. It supplies the power for the system of pure accumulator traction and for a short section of track with the overhead system. It has three direct-current generators, made by Gebr. Körting, Körtingsdorf bei Hanover, of 100 to 120-kw each, and 500 to 550 volts. For lighting there is a 9-kw motor-generator of 500, 110, 100 volts. The station battery consists of 60 cells of 240 ampere-hours; 80 amperes is the charging rate and discharging rate also.

The third central station is at Kirchrode, and furnishes power for about 10 miles of overhead system, and also the commercial current for light and power in several small villages in the vicinity. At this station there are two 165 and 200-kw, 500 and 550-volt generators. A motor generator of 33-kw changes this current to a voltage

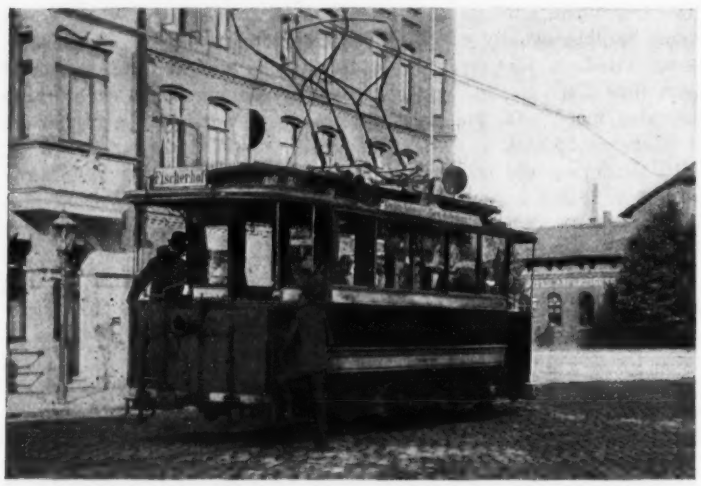


FIG. 2.—CAR WITH TROLLEY UP.

FIG. 3.—CAR WITH TROLLEY DOWN.

of 110 to 165 volts, which charges the buffer battery and supplies current for the booster circuit. For the light and power commerical current there are two belted three-phase generators of 66-kw capacity, 500 r. p. m., and 3000 volts between each phase, the periodicity being 50. The exciters are of 3.3-kw capacity. A rotary transformer of 33-kw (3 x 3000 to 550 volts) connects the two systems and enables them to help each other in case of need. All the electrical machinery in this station is by Siemens & Halske, Berlin. The buffer battery consists of 261 cells of 370 ampere-hours' capacity and 226 amperes charging and 370 amperes discharge rate. The high-tension line is strung on the same poles as the direct-current feed wires. Between the two circuits is a guard net which is well grounded. The current is transformed at different points in the outlying villages to 190 volts for power and 110 volts for light by static transformers of from 10 to 20-kw capacity. The low-tension light and power circuits are entirely separate.

FIG. 4.—ROAD AND RAILWAY WAGON.

The fourth central station is at Reihen, and furnishes the power for the interurban road between Hanover and Helelesheim, 18 miles (29 km.) of track, for three substations, and for the light and power commercial current in 15 or more small villages. The substation at Döhreñ and at Hasede furnish the power for the distant parts of the interurban road. There is also a third substation at Gehrden, which transforms the high-tension alternating current from this central station into low-tension direct-current for the trolley road between Hanover and Barringhausen. This station has one 220 to 300-kw direct-current generator of 500 to 550 volts, by Siemens & Halske, Berlin. Two three-phase belted generators of 440 to 570-kw and 6000 volts between each phase, furnish the high-tension current for the three above mentioned substations, and for the light and power service. Each generator has an exciter of 12 to 20-kw capacity. The storage battery here consists of 275 cells of 370 amperes-hours' capacity, 226 amperes charging and 370 amperes discharging rate. A 240-kw rotary converter connects the two systems, and enables the surplus energy of the alternating circuit to be sent into the battery. Each of the three substations has two 100-kw rotary transformers, which reduce the high tension (3x6000 volts) three-phase currents to the 550-volt direct current for the trolley road. The static transformers, which change the high-tension current to the commercial low-tension current, are usually from 10 to 20-kw capacity. The three-phase generators, the rotaries and the static transformers belonging to this current were all made by Brown, Bovers & Co., Baden.

The fifth central station is at Buchholz, and furnishes power for the line to the northwest of Hanover and for the commercial current for three small towns. The direct-current for the cars is supplied by two generators of 165 to 200-kw and 500 to 550 volts, made by Siemens & Halske, Berlin. In this station two direct-current generators of 44-kw each and 200 to 250 volts furnish the commercial light and power circuit with current. Two 10-kw dynamos, driven by a motor, generate the current for the "booster" circuit and for charging the battery, which consists of 132 cells of 648 ampere-hours and 216 amperes rate of charge and discharge.

The sixth central station is at Sehnde, and furnishes power for the stretch of track between Haimar and Ilten, and for light and power service in five small towns nearby. The power for the cars is generated by two direct-current dynamos of 165 to 220-kw and 500 to 550 volts, direct-current, made by Siemens & Halske, Berlin.

Two three-phase generators, of 66-kw capacity and 3x3000 volts, made by the Elektrizitäts-Aktien-Gesellschaft, Frankfort a. M., generate the power for commercial purposes. Their exciters are each of 3.3-kw capacity. A rotary transformer of 500 to 550 and 3x3000 volts connects the alternating current generating units with the storage battery and with the direct-current circuit. A direct-current motor-generator reduces the voltage from the large direct-current generators or from the rotary to the 110 and 165 volts necessary for charging the buffer battery, and also furnishes current for the "booster" circuit. The storage battery consists of 261 cells of 370 ampere-

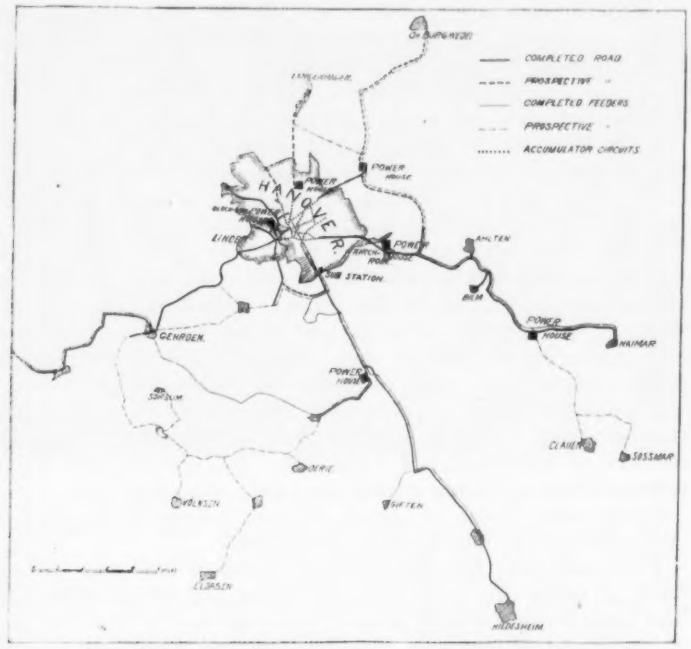



FIG. 1.—MAP OF HANOVER ELECTRIC RAILWAY.

hours' capacity. The charging rate is 226 amperes and the discharge rate 370 amperes. The high-tension current of 3x3000 volts is transformed for power purposes into a three-phase, 3x190-volt, three-wire circuit, and for lighting purposes to 110 volts. The static transformers are of 20 to 30-kw. The three-phase generator, the rotary and the static transformers belonging to this plant are made by the ElektrizitätsAktien-Gesellschaft, of Frankfort a. M.

The accumulators for all the stations and for the cars are of the Tudor type, made by the Akkumaoren-Fabrik-Aktiengesellschaft, Hagen and Berlin. Between all the high and low tension circuits is a well-grounded guard net. All the stations are connected by the company's private telephone line.

The company has in service some 100 or more freight cars of a peculiar type, called "Güterwagen für Land und Schienwege." They might be called "amphibious," as they are capable of going on either the railway tracks or on the highways. These cars have four large wheels and six small wheels. The large wheels, which resemble the wheels of an ordinary lumber cart, are of the same gauge as the track, and support the weight of the car and load. The other six wheels are small and flanged, serving only to keep the large wheels running on the track. When the car is to be used as a wagon, the small wheels are raised. These cars can be loaded at a point distant from the track, hauled to the track by horse or man power, and from there drawn by the motor cars to any part of the railway system.

The street railway system of Hanover and its vicinity, with its accompanying provision for light and power, is not fully developed yet, but work on it is proceeding at a fair rate.

## Municipal Ownership in Berlin.

In a special despatch to a daily paper from Berlin it is stated that the Municipal Council has resolved that in future all new street car lines shall remain exclusively under municipal management and control. No opposition is expected to this, as all parties, whether Socialists or otherwise, favor the idea. The municipality is bound by contract for a considerable period with existing lines. Therefore, it is impossible to transfer these avenues of transit to municipal management, as a majority of the council desire.

## Chicago Electric Railway Power Houses.

In view of the coming convention of the American Street Railway Association at Chicago, we include a supplement with this issue showing interiors of some of the typical electric railway power stations of Chicago. All the larger systems are represented by illustrations, except the Chicago City Railway Company. Views are also given of the power stations of the South Side Elevated Railway Company and of the Metropolitan West Side Elevated Railroad Company.

At present there are nine companies operating street railways in Chicago, as follows: The Calumet Electric Street Railway Company, 90 miles of track and 115 motor and 112 trail cars. Chicago City Railway Company, 157 miles of track, 776 motor cars and 749 trail cars; this company also operates 4.74 miles of track by horses and 34.75 miles by cable. The Chicago Consolidated Traction Company, 205 miles of track, 269 motor cars and 62 trail cars. The Chicago Electric Traction Company, with 35 miles of track, 45 motor cars and 20 trail cars. Chicago General Railway Company, with 30 miles of track, 30 motor cars. Chicago Union Traction Company, recently formed by the consolidation of the North Chicago Street Railway Company and the West Chicago Street Railway Company. The former company had 84 miles of track operated by electricity, employing 282 motor cars; the latter company had 165 miles of track operated by electricity, using 325 motor cars. Both of these lines also operate cable and horse cars. The Northern Electric Railway Company operates five miles of track. The South Chicago City Railway Company has 37 miles of track and employs 57 motor and 40 trail cars. The Suburban Railroad Company, with 46 miles of track, operates 20 motor cars and 4 trail cars; this company has also 10 miles of steam road, operating 4 steam cars and 4 trail cars.

Chicago, the centre of electric elevated railway development in this country, has four roads of this system.

The South Side Elevated Railroad Company has 18.62 miles of track, 46 motor cars of the Sprague system and 180 passenger cars. The Lake Street Elevated Railroad Company has 15 miles of track, 37 motor and 88 trail cars. The Metropolitan West Side Elevated Railway Company has 36 miles of track, 63 motor cars and 150 trail cars. The Union Elevated Railroad Company operates an electric railway loop around and through the business center of Chicago, furnishing a downtown terminus for the Metropolitan, Lake Street Railways and Northwestern (now being built), and receiving one-half cent per passenger carried over any part of the system, with a minimum guaranteed income.

Of the stations most recently constructed, the power house equipment of the elevated railways is, naturally, the most representative of current practice. In that of the South Side Elevated Railway the present equipment consists of four 800-kw 12-pole Westinghouse compound-wound dynamos with large overload capacity. The field pieces are vertically split and slide at right angles to the shaft, thus giving access to the armatures, which are mounted directly on the engine shaft. One of these units is illustrated in the supplement. Two additional units of 1600-kw capacity are now being built for this station by the Westinghouse Company. Each of the first-mentioned units is direct connected to horizontal cross-compound Allis 1200-hp engines, and the same type of engine will be used for the new generators, to be of 2450-hp each at a speed of 80 r. p. m., with 160 pounds of steam pressure, but capable of being worked up to 4000-hp. The generators are guaranteed to operate continuously at 1230 amperes, and for three hours without injury at 1835 amperes, the voltage being 650. At full load the machines have an efficiency of 94½ per cent. In the boiler room are twelve Babcock & Wilcox watertube boilers fitted with the mechanical stokers of the same company. The station is supplied with a complete system of coal handling apparatus.

Not being favorably situated with respect to condensation water, a Wheeler water cooling tower is employed. The tower is 34 feet high, 16½ feet wide, and 64 feet long, and contains vertical wire screens, down which the water to be cooled flows, having previously been pumped to the top of the tower. Ten fans each 10 feet in diameter, operated in pairs from the same shaft, force air into the tower, the consequent evaporation reducing the temperature of the water by the time it reaches the bottom from 30 to 40 degrees.

In order to further increase the economy of the plant, there are two large storage battery plants to take care of the fluctuations in the load; these are situated along the line, one at 12th Street and the other at 61st Street, each distant about three miles from the generating station. Each battery, consisting of 263 cells, has a capacity of 750-kw, and frequently delivers 2400 amperes to the line, and the output at times has been as high as 4300 amperes. It is interesting to note that the only attendance on the battery is that given by the ticket agent at one station and by the train despatcher at the other, who have merely to attend to the circuit breakers. Including lighting, air compressors for brakes, station lighting, switching and power for fan and auxiliary motors, the cars, which are operated on the Sprague multiple-unit system, average approximately 2-kw-hours per car mile in summer, and 3.55-kw-hours in winter, the latter figure including the electrical energy expended in heating the cars. The officers of this company claim to produce power cheaper than in any other electric plant in the world. The figures for the first six months of the present year are, per kw-hour, .40, .41, .40, .46, .46, .43 cent.

The power house of the Metropolitan Elevated Railway Company contains ten batteries of boilers, each of 300-hp, of the Babcock & Wilcox type, equipped with the mechanical stokers of the same makers. As in the case of the South Side power house, this station is provided with a complete system of coal-handling apparatus. There are two generating units of 300-kw, two of 1500-kw and two of 1650-kw, the generators being of the General Electric make and direct connected to Allis engines. In winter the maximum output is from 10,000 to 12,000 amperes at 600 volts and at the middle of the day from 4000 to 6000 amperes. The motor cars weigh from 30 to 35 tons, some being equipped with two, and others with four General Electric "2000" or "55" motors. The switchboard of this station is illustrated in one of the cuts of the supplement.

The Calumet Street Railway is claimed to be the largest suburban street railway system in the country. The power house is principally interesting from illustrating stages of progress in electric railway generating plant. There are four 150-kw Walker generators belted to Ball cross-compound engines, which had been transformed from non-condensing to condensing; also, an 800-hp Buckeye engine, direct-connected to a 500-kw General Electric generator. The Walker generators were substituted for original Detroit generators, and one is at times operated as a booster, raising the voltage up to 900 to 1000, as the occasion may require. For this purpose an additional bus-bar was placed on the switchboard, and connections made with a double-pole double-throw switch, this arrangement working very successfully.

When condensation was introduced, two Deane condensers were installed, and a system of cooling tables constructed. By this means a vacuum of from 22 to 23 inches is secured when the temperature of the atmosphere is 90 degrees and the temperature of the cooling tank 120 degrees. In cool weather a vacuum of from 24 to 26 inches is secured. The tables are about 12 feet wide and 70 feet long. The water passes from the delivery pipe to one extremity of the first table, and then flows to the other end in a thin sheet, thence falling upon a second table, from which it finally flows into a pond, whence it is pumped to the condensers. The deficiency in water is made up from the city mains, and by rain water led into the pond from the roofs of neighboring buildings. The boilers, eight in number, are of 2000-hp capacity, and equipped with Murphy mechanical stokers. The average output is 15,000 kw-hours, the maximum being 20,000 kw-hours. From one to three units are in operation, according to the load.

The interior shown of the power station of the Chicago Union Traction Company is that of the largest station of the company, which is located at Western Avenue and Washington Boulevard. This is the largest power station in Chicago. There are six engines, four of 2000-hp, one of 1700, and one of 1000-hp. Four of these are cross-compound Fraser & Chalmers engines, one a cross-compound George Corliss engine and one a cross-compound engine of the Pennsylvania Iron Works Company, each direct connected to a Siemens & Halske generator. The total capacity of the twenty Sterling boilers installed is 8000-hp. The smoke pipe is 234 feet high and 16 feet in diameter. The latest unit installed consists of a Pennsylvania 2000-hp cross-compound engine direct-coupled to a Siemens & Halske 1500-kw generator. The original generators had the commutator on the periphery of the armature, but three of these have been changed, commutators on the shaft of the usual type having been substituted. The new machine has a commutator of the ordinary type.

Two stations of the Chicago Consolidated Traction Company are shown, one at Lake Street and Harvey Avenue and the other at California Avenue and Roscoe Street. The latter has a maximum output of 30,000-kw-hours per day, and contains four direct-connected Siemens & Halske units of 750-hp and one of 1000-hp. There are

ten Campbell & Zell boilers of 3500-hp capacity, equipped with Murphy mechanical stokers, and four Fraser & Chalmers engines of 450-hp, and one compound Greene-Wheelock engine of 1000-hp, all non-condensing. The smoke pipe is 200 feet high, and has an internal diameter of 14 feet. The station is equipped with a coal conveying plant. The Lake Street station is of a more modern type, and contains two Siemens & Halske 750-kw generators direct-connected to Allis engines of 1000-hp each. There are eight Campbell & Zell boilers with a total capacity of 2400-hp, and equipped with Murphy mechanical stokers. Their fuel is handled by a coal conveyor. The chimney is 195 feet high and 12 feet in diameter.

The generators in all the stations of the Chicago City Railway Company are rope-driven. That at 52d Street contains 10 American-Wheelock engines of 750-hp, and the same number of Westinghouse generators of 500-kw each. In the 20th Street station there is one American-Wheelock engine driving a 500-kw Westinghouse machine. In the 49th Street station there are six engines of the same make as in the other stations, driving an equal number of Walker generators of a total capacity of 5200-kw, the boiler capacity being 7500-hp. All engines in the several stations are non-condensing.

## Municipal Ownership at Austin, Texas.

BY W. D. HORNADAY.

Brief mention has been made in the press despatches of the leaks in the great dam across the Colorado River at Austin, Texas, and the almost complete suspension of the operation of the municipal electric light and power plant on account of the limited supply of water with which to run the turbines. This serious condition of affairs will probably continue for an indefinite period, as there seems to be no way of stopping these leaks, which are gradually draining the great lake formed by the dam of its water. The people of Austin have come face to face with the problem of municipal ownership and it is hard to foretell what the solution will be.

The project of constructing a gigantic dam across the Colorado River at a point three miles west of Austin had its inception in 1890, and after considerable agitation the proposition for the city to issue bonds to the amount of $1,400,000 to carry out the enterprise was voted upon and carried by a big majority at a municipal election held on May 5, 1891. These bonds were sold and the work of constructing the dam begun. It was found that $1,400,000 was not sufficient to complete the work, and in 1894 another issue of $200,000 was voted. In addition to the proceeds from the sale of these bonds, about $150,000 were used by the city in completing the dam and constructing the municipal water works plant and electric light and power house, making the total cost of the enterprise about $1,750,000. The $1,400,000 of bonds bear 5 per cent. and mature in 40 years; the $200,000 issue bears 6 per cent. and also mature in 40 years. Nearly all of these bonds are held in the East.

Before the construction of the dam was undertaken it was asserted by competent engineers that it would be impossible to prevent leakages owing to the fact that all this section is of limestone formation, and sinkholes abound along the course of the Colorado River. Despite these warnings the great enterprise was carried out. While the work on the dam was still in progress, a large stream of water burst forth a short distance below it. Although it was thought to be a leak at the time, no effort to stop it was made. Since then other leaks have occurred, and it is claimed

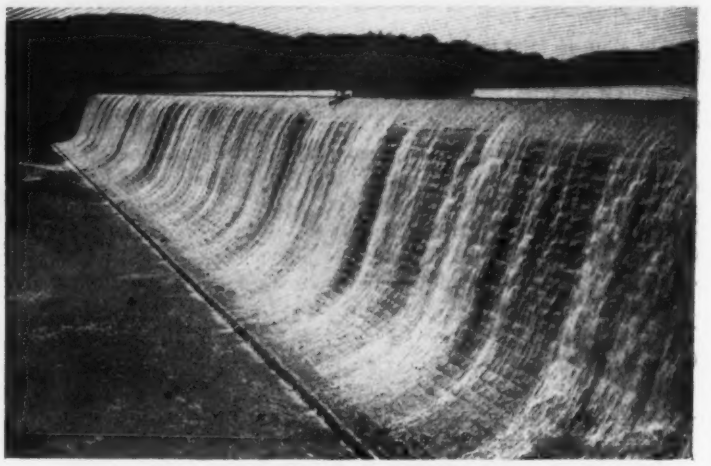


FIG. 1.—VIEW OF DAM WHEN FIRST FINISHED.

by those who have conducted an investigation that a big volume of water is pouring out from underneath the masonry work near the center of the dam. During the period from Aug. 14 to Sept. 14, of the present year, the water in the lake formed by the dam fell 10 feet, and that this great fall was due to leaks is shown by the fact that the volume of flowing water in the river below the dam is greater than usual for this season of the year. In addition to these leaks, the city authorities will soon have to contend with the problem of cleaning out the lake. The water in the lake at the dam was originally 60 feet deep. Soundings show that there is now but 27 feet of water, sand and sediment from the great watershed above having filled up the bed of the lake to a depth of 33 feet. No provision was made in the construction of the dam for cleaning out the bed of the lake.

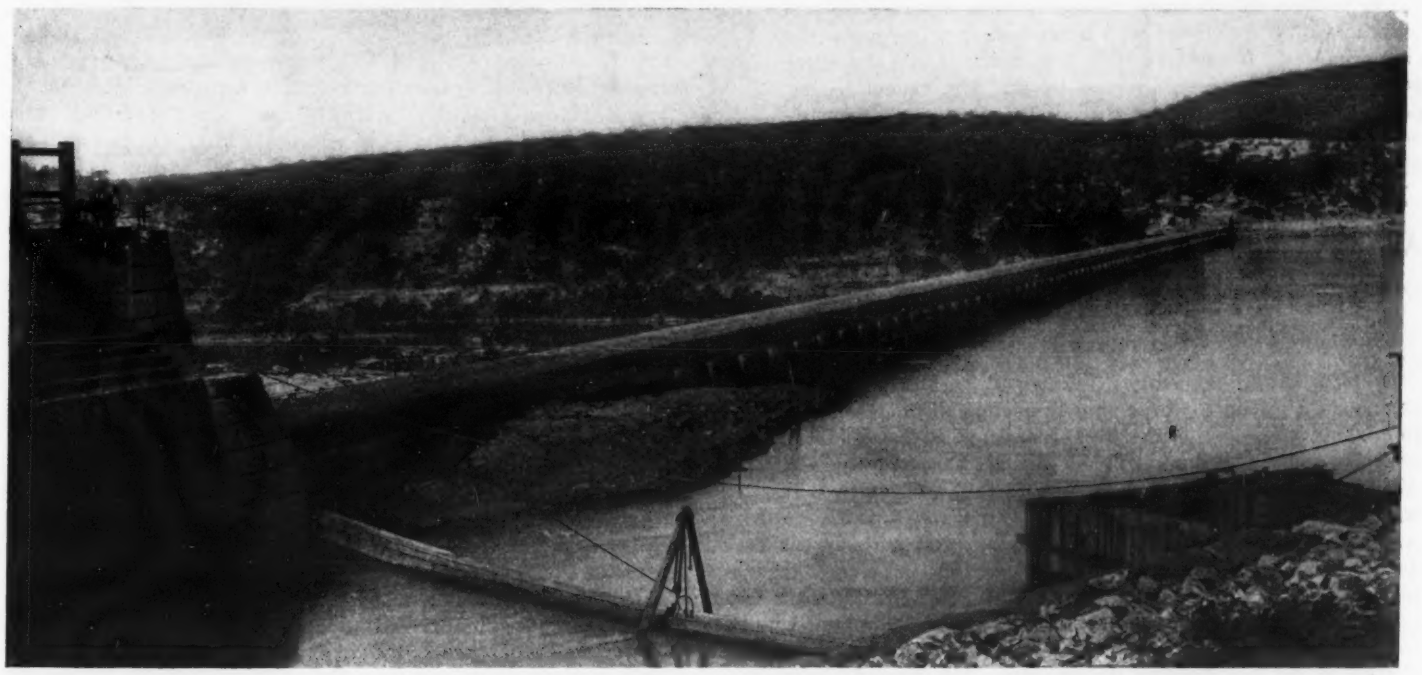


FIG. 2.—VIEW OF DAM SHOWING PRESENT STAGE OF WATER.

There are three penstocks at the dam. When the water in the lake reaches the crest of the dam the head of water at the penstocks is 16 feet. The city uses but one of these penstocks. It is

estimated that the average flow of the river is equivalent to 1100-hp without making any allowance for evaporation or leakage. It was estimated that the storage of the waters of the river by the construction of the dam would afford not less than 14,000-hp, which would give a surplus of 12,500-hp, the amount required by the city being only 1500. It was believed by the promoters of the project that there would be no difficulty in disposing of this surplus power to manufacturing concerns, and that the city would derive a handsome revenue from that source, but there has been no realization of these expectations, not a single manufacturing enterprise having been established here by reason of the water power advantages. The amount of water power now used by the city at the dam is from 300 to 500-hp.

The dam is 1300 feet long, 60 feet wide at base, 12 feet wide at the top and 60 feet high. It is cased with granite and the filling is composed of concrete and limestone.

The gross receipts derived by the city from the water works and electric light and power plant when it is in full operation are about $60,000 per year. The aggregate expenses of operating the plant are about $174,000 per year, including the $114,000 interest upon the bonded debt. Previous to establishing its own water porks and electric light and power plant, the city paid a private company here $18,000 per annum for better service than is now costing the taxpayers $174,000 per annum. The present city tax rate is $2.30½ on the $100. Before the building of the dam and municipal water works and electric light and power plant the tax rate was only 90 cents on the $100, sufficient revenue being derived from this rate of taxation to pay the private water and light plant for their hydrant service, street lights, etc., and also interest on $125,000 of bonds which the city had out at the rate of 10 per cent. interest per annum.

The present city valuation is about $11,000,000, which amount is much about the real value. Before the establishment of this gigantic municipal enterprise the property valuation of the city was $6,000,000, and with the tax rate of 90 cents there was derived sufficient revenue to meet every obligation. Storerooms in the business centre of the city that formerly rented for $100 per month now rent for $25 to $35 per month. If the estimate of $6,000,000 of real valuation for the city is correct, and with a bonded debt of $1,600,000, the city of Austin has been given a credit of over 20 per cent., when all statistics show that no corporation is entitled to over 5 per cent. of its assessed valuation.

The proposition is a hard one for the city authorities to deal with, and they are coping with it the best they can under the circumstances. It has been fully demonstrated that the water power which should be afforded by the dam cannot be depended upon and steps have been taken looking to the purchase and installation of an auxiliary steam plant to cost in the neighborhood of $75,000.

## Apparatus for Obtaining High Frequencies and Pressures.*

BY ELIHU THOMSON.

In 1889, Professor Henry A. Rowland, of Johns Hopkins University, in a discourse at the annual meeting of the American Institute, drew attention to the high frequency effects, and employed experimentally a Ruhmkorff coil, the discharge of the secondary of which charged some Leyden jars or condensers (Fig. 1), which were decharged over a spark gap through a few turns of wire carried on a frame as a large open coil with an air core, as shown. Opposite to this and parallel in plane, that is, in inductive relation to it, was another coil, acting as a secondary circuit receiving the high frequency induction, and between the terminals of which sparks were discharging at every discharge of the jars through the primary. He showed also that by attuning the two circuits, as by connecting condensers to the secondary circuit, the results were such that the frames or coils could be placed far apart without preventing the inductive action of the high frequency currents.

Professor Rowland had thus in this apparatus all of the elements of a high frequency coil except the step-up ratio between primary and secondary. As far back as 1877, it was my custom in lecturing on Electricity, to show the effects of the discharge of Leyden jars through the primary of an ordinary induction coil upon the secondary as step up apparatus, and the reverse; having, in fact, received the first suggestion of electric welding while discharging a battery of Leyden jars through the fine wire secondary, while noting the extremely heavy current set up in the primary circuit. By abolishing the iron core and winding only a single layer of secondary upon an insulating frame placed inside of a primary layer of but few turns, and immersing the whole in a tank of oil, we were enabled to produce the now well-known high frequency, high potential coil. It uses an alternating current of ordinary frequency with a step up transformer to charge the condensers, sometimes, with a strong air blast blowing upon the spark gap to insure regularity of discharges. Professor Rowland had employed the ordinary induction coil for charging his condensers and an ordinary spark gap. Tesla employed a high frequency dynamo to charge his condensers, and a blowout magnet over the spark gap, while in his high frequency coil he at first retained the iron core, discarding it later. A well-arranged, high frequency, high potential coil is adapted to reproduce many of the well-known beautiful effects of Ruhmkorff coils using a rapid break, but with increased brilliancy and effect, while other actions are peculiar to the very rapidly reversed discharges of the high frequency order. The construction of high frequency, high potential apparatus may, of course, be greatly varied. As an example of one form which has been employed by me, I may here insert a description of an apparatus giving 30-inch sparks between its terminals.

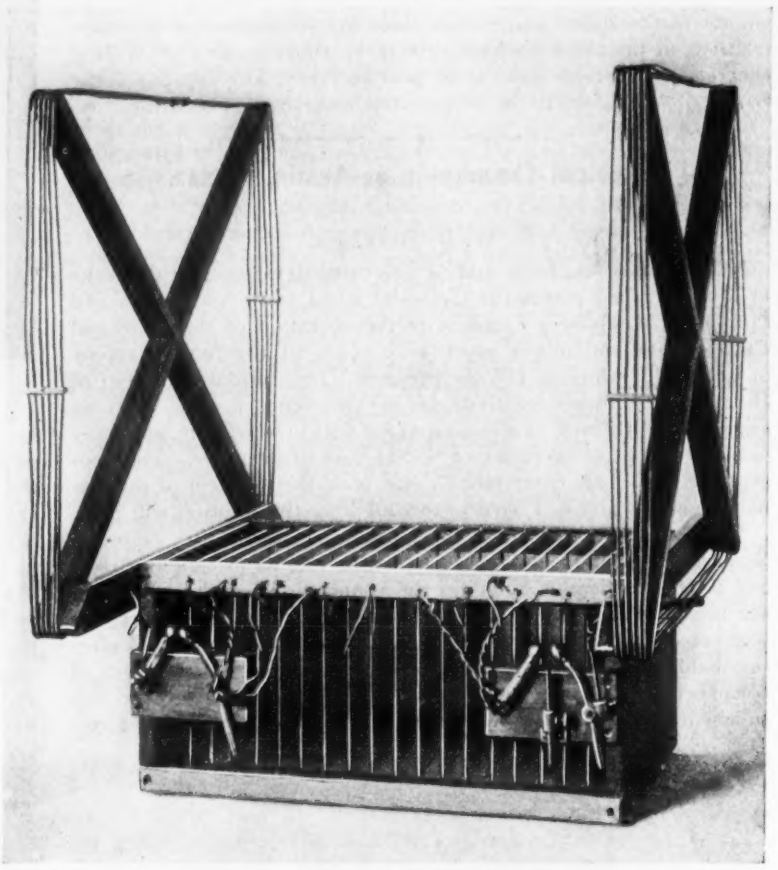


FIG. 1.—APPARATUS FOR HIGH FREQUENCY EFFECTS

A step up transformer, whose secondary gives 20,000 volts alternating current, is connected to charge the condensers, the discharge from which passes by air gaps through the primary coil of the high frequency apparatus. This primary consists of ten turns of wire wound on a wooden frame. The conductor is of two No. 6 wires placed side by side. This open coil is 18 inches long and 15½ inches diameter. Its resistance is .0088 ohms and inductance .0076 millihenrys. The secondary coil has 396 turns of No. 26 wire, wound as a single layer in notches on a hard rubber frame, the wires being spaced apart to form a coil 18 inches long. The diameter of the secondary is 12 inches and the weight of the wire

*Abstract from a lecture on "Electricity at High Pressures," delivered before the New York Electrical Society.

about one pound. The wire of the secondary coil layer equals 1250 feet, representing a resistance of 41.6 ohms and inductance of 25.2 millihenrys. These coils are immersed and supported concentrically in a vat of oil, and the secondary has its terminals carried to the brass rods and balls which form the discharge terminals of the apparatus.

There are used two condensers, all or portions of which may be connected for the primary coil discharge, each contained in a box 7 inches x 15½ inches inside, and 17½ inches deep. Each box contains 84 built up mica sheets 15 in. x 15 in. and .075 in. thick; 42 of these are coated with tinfoil 10 x 11 inches = 110 sq. in. Effective foil surface = 4510 sq. in. The condensers are immersed in oil in the boxes. The capacity of each condenser box is about .03 microfarad.

In the apparatus which gave 64-inch sparks between the terminals, the primary coil has a length of 28 inches and diameter of 22 inches. It has 15 turns of double No. 6; 85 feet of wire, doubled its resistance is .0147 ohms, and inductance .09 millihenrys. The secondary coil length is 28 inches, its diameter being 17 inches. The wire forms one layer with the turns spaced apart and carried in notches in a hard rubber frame, 580 turns in the layer. The wire is No. 26, about 2¼ lbs. or 2600 feet total length.

The condensers used with the primary were in three boxes, the dielectric being of mica plates and oil. When all were in use the capacity was .046 microfarads. These were charged by a large step up transformer to 30,000 volts and discharged across air gaps through the primary. An air blast was kept blowing on the gaps. The greatest distance at which it was possible—on account of the construction—to set the terminals was 64 inches, which was crossed with ease. The probability is that if the terminals could have been more widely separated, longer discharges could have been obtained. The current used in the primary of the step up transformer being of 125 cycles, there were at least 250 of the 64-inch discharges in each second.

Professor Trowbridge, of Harvard, has in recent years greatly magnified the effects of the Planté machine. He has arranged small storage cells to be charged in sets or in multiple by a dynamo, and then connected in series so as to give 10,000 volts or more of continuous potential at the terminals. With this battery of relatively high potential he charges in multiple a range of condensers consisting of glass plates coated on the two sides with tinfoil, except near the edges. By a large shifting frame worked by a lever he throws the connection of the condensers, after charging, into series order or cascade. The end condenser foils of the set are connected with the discharge terminals of the apparatus. In this way he obtains with great ease discharges of three or four feet in length, and of great brilliancy and beauty, one spark at each throw of the commutator lever. With a large machine of this type he has obtained sparks of seven feet in length, the distance covered being in fact limited by too close proximity of the walls of the building, its floor, its roof, etc., and not by the real capability of the apparatus, which, without the leakages and lateral discharges, would be capable of producing potential differences of 3,000,000 volts.

It was while studying the action of Professor Trowbridge's apparatus that it occurred to me to dispense with the large series of battery cells used in charging, and employ instead thereof the tops of the waves of a high potential alternating current suitably delivered in one direction. I was thus enabled to produce a new machine for obtaining high potential discharges. It consists partly of a motor-dynamo, such as is obtained by taking an ordinary continuous current motor and tapping the winding so as to obtain alternating currents. To this end two of the commutator segments or leads are connected to a pair of insulated metal rings on the shaft. Brushes resting on these rings yield alternating currents of a periodicity depending upon the speed and number of field poles. This machine may be driven by continuous current, or as a synchronous alternating current motor after starting, or it may be driven by mechanical power as a self-exciting alternating current dynamo. The alternating current brushes are connected to the terminals of the primary winding of a step up transformer, giving in the secondary a potential of, say, 10,000 to 15,000 volts. Driven by the shaft of the machine is a frame of insulating material as wood, having at one side a pair of metal strips which periodically connect the high potential secondary terminals of the step up transformer to the plus and minus foils of a set of condensers (eleven glass plates coated with tinfoil) in parallel. These connections, to avoid noise and friction are made without actual contact, that is, over a small spark gap. The revolving frame is so adjusted that the charging shall be completed only at the tops of the waves, and thus a high potential be available for charge. Moreover, in the particular machine before you (Fig. 2), the tops of only every third alternating wave of same polarity are employed, and thus the condenser plates or foils are always given the same polarity. In this way the chopped up alternating discharge becomes, for charging the condensers, a substitute for a high potential battery. The revolving frame carrying the charging strips also carries a set of series connectors whereby, after the charging strips have withdrawn from proximity to the stationary contacts led from the condenser foils, these contacts are connected in series as in the Planté or Trowbridge machines, and the terminals or end foils discharge across a wide air gap at high potentials, giving a rapid series of sparks of about 12 inches in length in the apparatus here

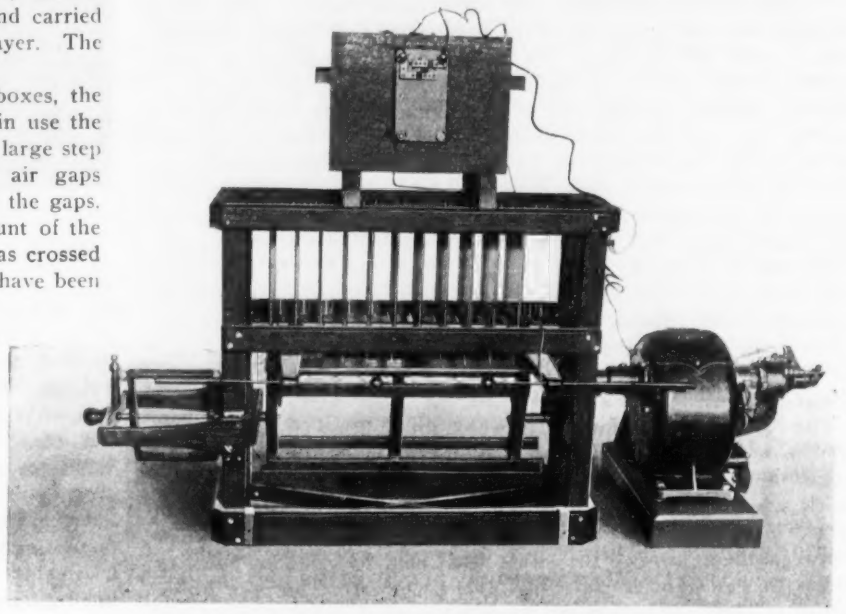


FIG. 2.—DYNAMO-STATIC MACHINE

shown. The length of spark is governed by the number of condenser plates and the potential of the charging current. This may be made to correspond with the maximum potential of the wave in the secondary of the high potential or step up transformer. I find shellacked wood sufficiently insulating for the parts of the machine outside of the condensers and metal connections.

The machine has been further developed and improved by me until it actually becomes a practical substitute for a static machine, independent of the weather. It, therefore, needs no outer case nor means for drying. I have added a simple attachment whereby Leyden jar batteries may be charged or a stream of thin sparks obtained, and with this attachment the machine may be used to excite the sectors of large influence machines, if desired, in all states of the weather.

This attachment consists of a revolving connector covering a wide gap between one of the terminals or end condenser foils and a stationary insulating ball or conductor. This connector itself, consisting of a pair of balls or rounded surfaces connected by a wire, is insulated and synchronously bridges the gap of several inches between the end condenser terminal and the insulated ball. The time of making this connection coincides with the series connection made by the revolving frame. The insulated ball or conductor thus is synchronously charged, while the opposite terminal of the apparatus may be put to earth. The ball may be made either positive or negative by changing the alternating current connections from the collector rings to the primary of the step up transformer or in other ways. A Leyden jar battery or condenser may be charged by connecting its interior coating with the insulated ball and its exterior to earth, or to the opposite terminal of the apparatus, and from the charged jar condenser a string, dipped in very weak acid or rubbed in graphite, may be made the means for conveying the jar charge slowly to a prime conductor for weak

or thin sparks, whereby the effects of a static machine may be closely reproduced.

The whole apparatus combines so many features of transformation of energy as to become a highly instructive apparatus for schools, and its capabilities are quite varied, as can be readily understood. I call it my Dynamo-static machine.

I may mention as an interesting fact that the new machine may be used to charge a set of condensers to a high potential in a second rheostatic machine, after which series connections being made, as in Professor Trowbridge's apparatus, a second multiplication of potentials would result. Very high potentials may thus be obtained.

## Illuminations at the Chicago Fall Festival.

By S. S. Sherman.

IN decorating Chicago for the Fall Festival held there at the beginning of this month for ten days, electricity was called on to play an important part. By night 15,000 electric lights transformed with their brilliancy dirty pavements and smoky buildings into visions of fairyland. By day, festoons of glittering lamp bulbs, sparkling in the sunlight, helped out greatly the flags, bunting and statuary in their task of furnishing the city with a holiday attire. Although the total quantity of decorations used by the city for the festival was not large, by being practically all bunched into a comparatively small space, it produced magnificent effects. State Street, the thoroughfare lined by the great retail stores, was selected for beautification, and a court of honor was created of the portion extending from Lake Street to Van Buren Street. In this space nearly all of the bunting, statuary and electric lights of the festival committee were placed. There were many other private displays all over the city, but the official efforts were practically all devoted to State Street. The splendor of the results obtained certainly showed the wisdom of the concentration.

The plan of the decorations, in which the lighting effects were included, was somewhat elaborate. At the south end of the court of honor a fine triumphal arch was erected. The north limit was marked by a pair of imposing pillars. Each of the corners of all street intersections contained a group of four rostral columns. Between these groups, the street was lined by rows of poles or masts 50 feet high, six on either side of the street in each block. From pole to pole across the street festoons of incandescent lights were hung. From each pole a large blue banner was suspended,

FIG. 1.—ILLUMINATIONS NORTH FROM COR. MADISON AND STATE STREETS.

and from pole to pole along the curb line, great festoons of red, white and blue bunting and American flags were stretched. The arch, pillars and rostral columns were made of white staff, and were decorated with statuary and flags. The poles supporting the lights and bunting were painted white, with ornamental arms and bases of white staff.

In this scheme of decoration, the numerous festoons of incandescent lights and their supporting poles played a most important part. The festoons were made in the same manner as those used in the Chicago Peace Jubilee, described previously in The Electrical World. In fact a large number of the festoons were used on the former occasion. They consisted of 16-cp incandescent lamps in keyless sockets protected by small inserted tin caps, strung in rows on a pair of conducting wires. The festoons were composed of 85 to 100 lights each, according to the two widths of the street—80 and 120 feet—and varying conditions as to the placing of the

FIG. 2.—LOOKING DOWN THE COURT OF HONOR.

poles. In the centre of each festoon was placed a 10-light cluster and at each end a 4-light cluster. Clear lamps alone were used, of 110 volts. The wire used was all of a good quality of rubber covered, and no trouble was experienced from short circuits or leakage. The festoons were hung at the centre by No. 6 galvanized iron wires stretched across the street from building to building, 58 feet from the ground.

Six of these festoons were placed in each block, with special ones at the street intersections. They were all connected to the street mains of the Chicago Edison Company. Taps were made on the service wires running under the sidewalks in the various basements, and the wires run up inside the buildings to the level of the festoons, when they were taken across straight to the supporting masts. The switches were placed in small locked storm boxes against the front of the buildings within easy reach of the sidewalk. Each box contained one 3-wire knife switch, on which were two festoons. In turning on or off the lights, four men were employed, the whole task taking five minutes. Two men started from either end, one on each side of the street. They unlocked the storm boxes and threw the switches as fast as possible, meeting in the centre of the illuminated stretch. There was considerable talk of arranging the entire lighting on one switch to be thrown by President McKinley, but the expense was found to be considerable and the project was abandoned.

In the festoon decorations, over 5000 incandescent lights were employed, all on the Chicago Edison Company's incandescent circuit. Alternate festoons were put on opposite sides of the 3-wire system of the company. The total current required for the system was 1250 amperes at 220 volts. The entire wiring work was completed in a little less than 10 days. J. H. Goehst, the superintendent of construction of the Chicago Edison Company, who was also a member of the Festival Committee on Decorations, took personal charge of the work.

Besides the festoon lighting, the Chicago Edison Company also installed for the festival management four large General Electric searchlights. Two of these were for the purpose of lighting the arch at the south end of the court of honor, and two for the pillars at the north end. They were placed on the tops of buildings 300 feet away from the objects of illumination and produced a splendid effect. Thirteen-inch lenses were used. Each light took 30 amperes of current at 220 volts. This swelled the total Edison current for the festival effects to about 1375 amperes.

Mention of the scheme of festival lighting would not be complete without a notice of the gas effects produced. At each of the masts along the street four flambeaux burning gas were placed. Gas was piped from the street mains of the People's Gas Light & Coke Company. The effect of the flaring yellow torches served to heighten and increase the brilliancy of the electric lamps.

Besides the festival lighting, there were many brilliant private electric displays, almost all of which were confined to the court or honor. Several of the large retail houses used from 500 to 1000 incandescent lights in their signs and along their store fronts. Probably the most unique of these effects was produced by the firm of Mandel Brothers, which had a model of the Olympia done in 16-cp lights on the west side of its building. The Chicago Board of Trade was conspicuous for its shield, eagle and flag of lights on the front of the building. The most elaborate private efforts, however, were those of the Union Elevated Railroad Company, which used 3000 lights in decorating its structure. The majority of these lights were placed at the two State Street stations of the Union Loop. They consisted of a flag of 510 small red, white and blue lights, the four stars of Admiral Dewey, and various inscriptions of welcome. The Lake and State Streets stations bore the inscription done in 16-cp lights: "Do-we carry the people? We do." With the exception of the flag lights, the effects were produced by 110-volt lamps strung in series of five across the railway circuit of the company.

The other electric effects at the jubilee were confined largely to three floats in the night parades lighted by small incandescent lights. These floats were built for Siegel, Cooper & Company, and were wired by the Chicago Edison Company. Each one carried an automobile storage battery equipment of 40 cells of the 75 ampere-hour type made by the Woods Electric Vehicle Company. About 150 lights of 3-cp each were used on each float, largely for the purpose of giving light enough to show the character and occupants of the float. On one of the floats, representing the original thirteen states, the lights formed a huge shield or banner, in the middle of which were thirteen girls representing the states. This float was used in the historical parade.

## Seventy-Fifth Anniversary of Franklin Institute.

The National Export Exposition, now being conducted in Philadelphia, is under the joint auspices of the Philadelphia Commercial Museum and the Franklin Institute of the State of Pennsylvania. The Franklin Institute has taken advantage of this occasion to hold a series of public meetings of its sections at the exposition, commemorative of its seventy-fifth anniversary.

The meetings of the first day were held under the auspices of the Chemical Section, and on Tuesday Prof. Geo. A. Hoadley, president of the Electrical Section, opened the proceedings of that section with a brief address of welcome, and introduced the speaker of the evening, Dr. Edwin J. Houston.

Prof. Houston's paper was on "The Seventy-fifth Anniversary of the Franklin Institute from an Electrical Standpoint." He spoke of the work accomplished by the Institute in the general advancement of science, and pointed out that the last century and a half will take in very nearly all the discoveries and inventions made in electricity; the last century will include by far the most important of these discoveries and inventions; the last half-century, the most valuable and useful, and the last decade and a half, the period of their most extended commercial applications. In order to determine the nature of the influence which the Franklin Institute, founded as it was in 1824, exerted on electrical science and its useful allied arts, he called attention to the conditions under which the best type of scientific work can be carried out.

He showed that these conditions consist essentially in mutual work. He alluded to the enthusiasm begotten of comradeship, and showed how the association of men of similar interests not only result in the better carrying out of their work as a whole, but also insuring more earnest and intelligent work on the part of the individual workers.

Dr. Houston dwelt especially on the fact that the highest type of scientific knowledge finds its expression in the production of actual working machines or processes. As an inference from these general truths, he declared that the marked growth which the Franklin Institure possesses to-day has been achieved because its work has possessed the following characteristics.

First, co-operation of work undertaken jointly by men learned in books and men learned in things; a great working brotherhood of theory and practice. Second, the widest possible publication of ideas born in its midst, or presented to it for consideration. Third, reduction to practice, by subjecting all discoveries and inventions to actual, everyday use.

After pointing out the many advantages possessed by the Institute for carrying on the above characteristic lines of work, Dr. Houston said he would content himself in endeavoring briefly to trace the influence exerted on the growth of electric science and its allied useful arts, by the International Electrical Exhibition, conducted in Philadelphia in 1884, under the auspices of the Franklin Institute of the State of Pennsylvania. After briefly tracing some of the characteristic features of this great exhibition, he alluded to the significant growth in the commercial application of electricity that has been reached, in nearly all cases, at dates subsequent to 1884. While he by no means desired to claim the exhibition of 1884 as the sole cause for this growth, yet he believed that it was one of the determining causes, if not the principal cause. He alluded to the fact that many other good results which arose from this exhibition, was the great American Institute of Electrical Engineers, which practically had its birth at this exhibition. In speaking of this fact, he said: "This great body of eminent electricians that has done so much to direct electrical science both in this country and abroad, may, strictly speaking, be claimed as the child of the Franklin Institute, and, although it has always been an independent and separate body, yet the friendly relations existing between the two institutions may be inferred from the fact that out of the twelve presidents of the American Institute of Electrical Engineers, five have been selected from members of the Franklin Institute, and that during the nearly fifteen years of the existence of the American Institute of Electrical Engineers, for eight of these years it has been presided over by a member of the Franklin Institute."

In order to trace the influence exerted by the Franklin Institute on electrical science and its allied useful arts, as they exist to-day, Dr. Houston made a somewhat extended résumé of electric progress from the earliest time down to to-day. During this résumé he took occasion to point out the fact that electrical progress was by no means uniformly distributed throughout the past. Periods of comparative inactivity were followed by periods of marked activity. In other words, era-making discoveries and inventions, removing as they did, obstacles to further progress, and exciting, as they naturally would, attention to electric science, would give greater incentive to further progress.

Some of these era-working inventions were the discovery of the Leyden jar, by Von Kleist, in 1745; Franklin's discovery as to the identity of lightning and electricity, and his invention of the lightning rod, about 1752; Volta's invention of the voltaic pile in 1796; Davy's immortal discovery of the compound nature of the alkaline earths, in 1807; Oersted's discovery of the relation between electricity and magnetism in 1820; Faraday's immortal discovery of magneto-electric induction, or the production of electricity from magnetism, in 1831, and his early form of dynamo-electric machine, and the production, almost immediately afterward, of the early dynamos and electric motors; the production of the electromagnet by Sturgeon in 1825, and by Henry in 1838; of the invention by Daniell of his constant voltaic cell in 1836, and the marvelous growth in electro-telegraphic systems, by Morse in America, Steinheil in Munich and Wheatstone and Cooke in England, culminating, as they did, in the laying of the first telegraphic cable by Field in 1858.

He pointed out the fact that the last quarter of the nineteenth century, which was, as we all know, a period of marvelous activity in electric science, showed unusual activity during the fifteen years that followed the holding of the Franklin Institute International Exhibition of 1884; he suggested that if the name of the "Age of Electricity" could practically be given to the nineteenth century, at least its last decade and a half might pre-eminently be regarded as the "Age of Commercial Electricity," and that it would seem probable that this would be the characteristic feature of the twentieth century, at least so far as electric science is concerned.

Dr. Houston then gave some data concerning the marvelous extent of the growth of the commercial application of electricity since 1824.

Mr. Ralph W. Pope, secretary of the American Institute of Electrical Engineers, followed Dr. Houston, and spoke on "The Influence of Technical Societies in Promoting the Progress of the Electrical Arts."

Mr. Pope, among other things, pointed out the fact that a most valuable characteristic of a society like the Franklin Institute is the continuity of its work. The individual members are mortal, but the organization lives and its work persists. Mr. Pope referred to another exceedingly important duty, voluntarily undertaken by the society, which is of immense economic value. This is the introduc-

tion of standard practice in the arts. Among the examples that may be cited are "Standard Rail Section," by the American Society of Civil Engineers; "Standard Boiler Tests," by the American Society of Mechanical Engineers, and within the present year, the "Standardization of Electric Generators, Motors and Transformers," by the American Institute of Electrical Engineers.

It is to be remembered that the Franklin Institute should be given credit for the organization under government auspices, of the National Conference of Electricians in connection with the Electrical Exhibition at Philadelphia in 1884. He also confirmed Dr. Houston's statement that it was at this exhibition that the American Institute of Electrical Engineers practically had its birth.

Concluding, Mr. Pope said, "Having been assigned the duty of pointing out the advantages accruing from the existence of such organizations as the Franklin Institute, whose seventy-fifth anniversary we have assembled to celebrate, I have gone a little further, and intimated that they might be still more useful if the public generally were brought into closer touch with their proceedings.

"We need have no apprehension as to the future of our great technical societies. There are the best reasons for their continued existence and healthy growth. Their deeply embedded foundations are beyond reach of those discordant elements, which frequently revolutionize government, divide our churches and overthrow the greatest financial undertakings."

Prof. F. B. Crocker, of New York, was announced to deliver an address on "The Commercial Aspects of American Electrical Industries," but was, unfortunately, unavoidably prevented from doing so.

The proceedings of the Mining and Metallurgical Section were opened by the president of the section, Mr. James Christie, superintendent of the Pencoyd Iron Works, who made a brief address setting forth the anniversary purposes of the section, and gave a succinct résumé of the useful work that it had accomplished. The president then introduced Mr. Charles Kirchhoff, editor of the *Iron Age*, who delivered an address on "The Progress of the Mining and Metallurgical Arts During the Past Seventy-five Years."

The speaker alluded to the growing interdependence of the various branches of the mechanic arts, showing how the metallurgical arts were promoted by the mechanical and electrical engineer, and especially dwelt upon the extent to which it is now recognized among metallurgists that electrical science is one of the most powerful aids to the advancement of the mining and metallurgical arts.

Mr. Kirchhoff was followed by Mr. John Fritz, of Bethlehem, the nestor of ironmasters, who gave an exceedingly interesting narrative of his personal reminiscences of the growth of the iron and steel industries.

On Thursday, Oct. 5, Mr. Wilfred Lewis, president of the Mechanical and Engineering Section, made the introductory address. He alluded to the growing necessity that requires the constant division and subdivision of the various branches of science, and their allied arts, and pointed out how the Franklin Institute was meeting this requirement by the establishment of additional sections. He referred to two most recent of these additional sections, viz.: "The Physical and Astronomical Section," and "The Mechanical and Engineering Section," which, on account of their recent birth, he characterized as "The Jubilee Twins." He then gave a brief résumé of the recent history of the Mechanical and Engineering Section, and introduced Dr. Coleman Sellers, who gave an address on "The Progress of the Mechanic Arts in Three-Quarters of a Century."

Dr. Sellers gave some interesting facts concerning the development of the locomotive, which he said was coincident with his own lifetime. He pointed out the significance of the birth of the machine-tool industry, upon which continuous progress in the mechanical arts so largely depended. He gave some interesting facts concerning the construction of Oliver Evans' early steam engines. He alluded to the revolutionary discovery of Asa Whitney in the manufacture of cast-iron car wheels. He called attention to the results obtained by William Sellers & Company, of Philadelphia, in the production of a machine for rapidly boring the cylinders of locomotive engines.

On Friday, Oct. 6, Dr. A. E. Kennelly, president of the Physical and Astronomical Section, made the introductory address. He called attention to the fact that although the Physical and Astronomical Section of the Institute was the youngest of its sections, yet the sciences it represented, physics and astronomy, were the oldest of the natural sciences. He referred to the important part the applied physical sciences generally played in existing conditions of life, questioning whether the dense populations in such centres as London or New York City could exist without their aid. He pointed out, as a natural result, how this dependence was taxing the applied sciences to the utmost limit, in demanding cheaper, simpler and more effective working, resulting in a competition between machines keener than competition between men. In conclusion, he said, "It is then to the applied sciences of the future that we must look for the advances that are to make the world happier and greater than it is today."

Dr. Kennelly then introduced Dr. T. C. Mendenhall, of Worcester, Mass., who delivered an address on "Some Notable Contributions of American Physicists During the Last Three-Quarters of a Century."

Dr. Mendenhall began by alluding to the spirit of optimism existing in all ages and manifesting itself at any given age by regarding that age as the World's "Golden Age." He briefly outlined the work of some of the many able physicists of the United States who had conferred honor on their country by their contributions to physical science. Among some of the more prominent of these he mentioned Benjamin Thomson, afterwards known as Count Rumford, who first pointed out the true nature of heat as a form of energy; Dr. John W. Draper, noted for his researches in radiant energy and capillary phenomena, and L. M. Rutherford, who made valuable contributions in celestial photography and solar spectroscopy. Prof. Langley, the Clarkes, both father and son; Brashear and Rowland were also mentioned.

In referring to the contributions in electricity and magnetism, he mentioned, among others, the names of Franklin and Joseph Henry, referring especially to the important work done by the latter in connection with the electromagnet and electromagnetic telegraphy. In terrestrial magnetism and meteorology he referred to the work of Bates, Espy, Loomis, Ferrel and Abbe.

On Saturday, Oct. 7, Dr. John Birkinbine, the president of Franklin Institute, after delivering an introductory address, introduced Rear Admiral Geo. W. Melville, Engineer-in-Chief, U. S. N., who delivered an address on "The Modern Warship, as Containing in Itself the Highest Results in Skill, Industry and Scientific Knowledge."

The Admiral pointed out the fact that the modern warship has naturally resulted from the intelligent application of principles received from many branches of the physical sciences, and referred to the important pioneer work of Isherwood, Ericsson and Dahlgren. He laid particular stress on the problem which constantly confronts the naval designer, namely, "The maximum offense combined with the maximum of defense and the maximum of speed." He also referred to an additional important limitation, i. e., that of weight, by which the naval designer is also handicapped. During his remarks he referred to the pleasure he had in taking part in the celebration of the seventy-fifth anniversary of the Franklin Institute, which, he said, had done so much in advancing engineering and the mechanic arts.

Dr. Robert H. Thurston, of Cornell University, was then introduced, and delivered an address on "The Evolution of Technical Education and the Work of the Franklin Institute During the Past Seventy-five years." Dr. Thurston traced the progress of technical education from the earliest dawn of historic time. He showed that technical education was known to the earliest historical nations, and traced the establishment of the common schools in the past and of the schools of engineering and architecture of more recent date. He pointed out the significant fact that much, if not the greater part, of the work in the direction of technical education, was accomplished during the seventy-five years of the existence of the Franklin Institute. He referred, among other things, to the technical schools, lectureships and scientific investigations inaugurated by the Franklin Institute, and called attention to the important aid thereby afforded to invention and inventors.

## Passion Play by Trolley.

There are indications that the influx of visitors to Oberammergau next year will far surpass all previous pilgrimages. From all parts of Europe and America, and especially from France, numerous letters have reached the priest and village authorities asking for information. It is now definitely settled that the first representation will be on May 20, and that the last will be at the end of September. There will be twenty-eight performances in all. The tedious two hours' drive to the village from the railway will be abolished, as well-equipped electric motor cars will take visitors from Oberau in half an hour.

## Frequency Measurement.

In a communication to us, Prof. W. R. Ayrton directs attention to a paper read by himself and Prof. John Perry before the Institution of Electrical Engineers some ten years ago, in which the subject of frequency measurement is considered. In this paper are mentioned the method proposed by Prof. Kinsley and also the several methods referred to by Mr. T. V. Carpenter in our issue of Aug. 5, as well as one later applied in an instrument now manufactured by Nalder in England under the name of "Frequency Teller." Prof. Ayrton informs us that the stretched-wire apparatus is in regular use in his laboratory, and has been so for years. The plan he generally employs is to use a permanent magnet and send the alternating current, the period of which it is desired to know, through a non-magnetic wire. The magnet has extended polar surfaces near together, as shown in the accompanying illustration, where *W W* is the stretched wire in the narrow gap. Following is a reprint of that portion of the paper referred to which deals with the subject of electric frequency measurement.

Some time ago one of us suggested, during a discussion on transformers, that a method might be used for analyzing an alternate-current wave which somewhat resembled the employment of Helmholtz's resonators for analyzing a complex sound vibration. The method then proposed consisted in sending through one of the coils of a dynamometer the current to be analyzed, and through the other an alternate current of known frequency, and varying the frequency of the test current until an attraction was observed between the two coils. The smallest frequency of the test current that will produce such an attraction gives the fundamental rate of alternation of the current which is being analyzed, and the magnitude of the attraction between the two coils of the dynamometer the amplitude of the fundamental rate of alternation. The frequency of the test current is then gradually increased until an attraction is again observed between the dynamometer coils, from which the frequency and amplitude of the first higher rate of alternation is determined, and so on for all the component vibrations.

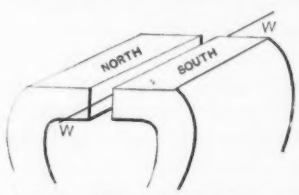
This method has been used with a certain amount of success by Messrs. Lamb and E. W. Smith at the Central Institution for the analysis of the current produced by the Ferranti machine. Previous experiments had shown us that this current was not a simple sine function of the time, as the curve rises less rapidly and falls less rapidly than a true sine curve. The difference, however, between the two is not very great, and the unimportance of the harmonics compared with the fundamental rate of vibration in the current curve of the Ferranti machine renders the analysis of this current a severe test of the method, which, however, was sufficiently sensitive to show that the Ferranti current wave consists of a fundamental rate of alternation, no appreciable components either for twice or three times the fundamental rate of alternation, but sensible components having respectively four and five times the rate of alternation of the fundamental; that is, the alternation is made up of a fundamental and the third and fourth harmonic.

Quite recently two of our students—Messrs. Healing and Le Tall—have been experimenting on another resonance method of analyzing an alternate-current vibration which we have suggested to them, and, considering how rough is the apparatus they have been using, and how short a time they have been engaged on this new method, the results are unexpectedly satisfactory, and appear to show that this method, which is extremely simple, is one of great promise. The alternate current to be analyzed is passed through a stretched wire, *W W*, the length or tension of which can be varied as in a monochord. This wire is in a magnetic field produced by a permanent magnet, or by an electromagnet, or, best of all, by a coil of wire surrounding the wire *W W*, as a flat galvanometer coil surrounds the needle. As the current in the wire alternates the wire receives impulses backwards and forwards across the lines of force produced by the magnetic field, and if the length and tension of the wire be adjusted by trial until the natural time of vibration of the wire agrees with the periodic time of variation of the alternate-current, the wire oscillates vigorously with an amplitude from 1½ to 2 inches, emitting, of course, a musical note. The sudden way in which the wire starts vibrating when its length and tension are just right is very striking. The frequency can be determined from the musical note emitted by the wire; but as that would require tuning-forks or some other apparatus having fixed rates of vibration, as well as a musical ear, we prefer to determine the frequency by using the well-known formula for a vibrating string, viz.,

$$n = \frac{1}{2l}\sqrt{\frac{t}{m}},$$

where $n$ is the frequency, $l$ the length of the wire in centimetres, $t$ the tension in dynes, and $m$ the mass in grammes per centimetre of the wire.

In the first experiments we commenced with the wire comparatively slack, and on gradually tightening it up it was seen to vibrate very slowly. Holding one's finger on the wire and counting the vibrations, they were found to correspond with the speed of the engine driving the alternate-current dynamo, *D*, which was sending the alternate current through the wire. On tightening up the wire a little more it responded to twice this rate of vibration, which may, perhaps, have corresponded with the number of piston strokes; then the wire required a good deal of tightening, when it suddenly burst into vibration, and on calculating the value of $n$ from the formula just given, a result was obtained closely agreeing with the electric frequency, which, with the particular dynamo employed, was eight times the number of rotations of the armature per second. On tightening the wire still more, shriller notes were heard, and smaller waves seen superadded on the fundamental vibration of the wire as a whole. We were at first afraid that the analysis of the harmonics of the alternate current would be troubled by the vibrating wire having harmonics of its own, but we were reminded by Mr. Lamb of the well-known fact—which we ought to have remembered—that the harmonics possessed by the vibrating string of a musical instrument are impressed on it in the act of setting the string in vibration, or, in other words, that a string has no harmonics of its own. Hence we may safely conclude that the higher rates of vibration seen and heard with out wire are really due to harmonics in the alternate-current wave itself. To determine the frequency and amplitude of each of these harmonics the length and tension of the wire are adjusted until its natural period of vibration agrees with the particular harmonic sought for in the alternate current, and which agreement is evidenced by the wire vibrating vigorously when it is attained.



FREQUENCY MEASUREMENT APPARATUS.

We have not yet gone beyond this point in our experiments, but some modifications and developments of the method that have occurred to us may be briefly referred to. Instead of tuning the wire to accord successively with each of the harmonics sought for, it may be found convenient to have a number of wires tuned to give out, and therefore to respond to, different notes, as in a harp, and placed in a magnetic field, then to send the alternate current to be analyzed through them in parallel or in series (probably the latter would be better), and observe which of the wires vibrate, and what are the various amplitudes of vibration. Or, instead of sending the alternate current through the stretched wire or wires, it may be sent round a solenoid or electromagnet, and a direct current sent through the stretched wire or wires, placed relatively to the solenoid so that a current in the wire or wires is deflected by a current passing round the solenoid. Or, in place of a vibrating wire, a magnetic tongue the natural rate of vibration of which can be varied by altering its length or its moment of inertia, or in some other convenient way, may be placed near a solenoid or electromagnet round which flows an alternate current. Or a set of such tongues tuned like the vibrating springs of a mouth organ may be employed to analyze an alternate current sent round a solenoid or electromagnet.

In the figure the alternate-current dynamo is shown near the vibrating wire, but it will be obvious that any one of these arrangements may be employed to measure the frequency of an alternate current at *any distance* from the dynamo. Or they may be used simply to measure the speed of the dynamo at any point of the circuit through which flows the alternate current produced by the dynamo, if the number of alternations per revolution—which is, of course, a definite number for each dynamo—be known. Or, generally, if there be attached to any moving mechanism some arrangement for making and breaking a current, or varying the strength of a current, any one of these methods may be used at any distance

from the moving mechanism to measure the frequency, and, therefore, the speed at which the mechanism is moving. So that the arrangement can be used as a simple speed-indicator for indicating at a distance the speed of moving machinery.

If the vibrating wire consist of two or more wires mechanically joined together, but electrically insulated from one another so that different currents can be passed through them, then, if the currents be of the same frequency, we can use our method for comparing the mean value of the algebraic sum of the currents with the mean value any of one of them; and by comparing the mean value thus found of the algebraic sum of two currents with what the mean value would be were there no difference in phase, we can determine this difference in phase. And the same thing may be done by sending the currents round different wires on a solenoid placed so as to cause a magnetic tongue to vibrate.

In fact, we have ourselves hardly yet realized all the uses to which this "electric frequency meter" can be put.

## Electrolysis from Electric Railway Currents.

In a paper read by Mr. W. S. Wynkoop before the sixth annual convention of the American Society of Municipal Improvements at Toronto, Oct. 3, the subject of electrolysis from electric railway currents was considered from the standpoint of the municipal electrician, the illustrations adduced by the author referring more particularly to the conditions existing in Brooklyn.

In that city the conditions are very complex. There are some 600 miles of single track, six railway power houses well distributed, and a daily average of a little less than 1900 cars in operation, including the motor cars of the elevated system. Underground are gas and water pipes, railway tracks, Edison tube, cement-lined iron subway ducts, unoccupied, earthenware subways containing lead covered cables, supplementary wires and bundles of old rails used as ground returns. In addition, the elevated structure itself is being made the equivalent of a ground return through its bond connections with the track it supports. All of these conductors are jumbled together forming an irregular network through which the stray electricity is dodging hither and thither. To increase the complication, intentional connections between dissimilar conductors have been made from time to time, at the instance of experts retained by one or another of the corporations.

In earlier days the most generally accepted method of dealing with electrolysis involved the attaching of a bond wire to the damaged spot in order to conduct away harmlessly the electricity that was causing the trouble. By means of these bonds the various corporations are caring, in specific instances, for stray currents in amounts ranging from 20 to 80 amperes. Each corporation has its own expert watching developments, and its own remedies, regardless of the effect upon its neighbors of the disturbance of the electrical equilibrium thus occasioned.

In 1896 careful examinations were made of the pipes at so-called danger points, and all resulted in an utter failure to detect any evidences of electrolysis. Since that time no instances of damage to the city's cast-iron have gone on record, nor has any damage occurred to the cast-iron of the Brooklyn Union Gas Company, a corporation controlling nearly all of the gas mains in Brooklyn. On the other hand, cast-iron coupling boxes of the Edison Electric Illuminating Company have in places been badly corroded.

Some singular expedients resorted to in order to secure relief from electrolysis were noted. In one case, a pipe is carried overhead across the street, thus avoiding any near approach to the rails. In other instances heavy rubber hose have been slipped over the lead service lines in locations where much electrolytic trouble has been experienced; it is added that it is surprising how long the rubber will last, and, of course, the pipe is safe during the lifetime of the hose.

The wrought iron and steel services of the gas system are attacked and the gas company is suffering from an abnormal leakage of gas. Telephone cables appear to be reasonably safe, but electric light cables are in an unsatisfactory condition. Edison conduit tubing is suffering greatly in some places. The water and gas mains, however, as stated above, are as yet unharmed. In Brooklyn, this piping consists of a very hard, dense, heavy-grained white cast-iron, containing alloyed, rather than combined carbon, and coated with some variety of asphaltic varnish.

As to remedies, it is stated that electrical ones have thus far failed. The improved track return is a palliative but not a cure. The interbonding plan results in a ceaseless disturbance of the electrical equilibrium. The auxiliary potential method is applicable only to those towns whose electrical map is comparatively simple, and few of the larger towns come within this class to-day. The insertion of insulating sections of piping along the line tend to throw an increased burden upon other conductors. Finally, not one of these suggested remedies offers more than a partial and temporary relief. All of them delocalize and render latent the evidences of electrolytic decay, but to just what extent it is a hard matter to determine. Voltmeter surveys are undoubtedly valuable, and yet after all they are merely resultants, so that when accepted in their true light, they afford no certainty that local action is not taking place in the immediate vicinity of the test points. The conclusion of the author is that the problem must be attacked from the standpoint of chemistry.

As to the relations of the municipality to the subject, the writer sums up the situation by quoting the four stereotyped answers to complaints, which answers, he states, are employed by city authorities everywhere:

First, to the private citizen: "Oh, yes, we have had a number of complaints lately about the failure of water services. If you will go to the office of the street railway and state your case, the company will in all probability pay your plumber's bill. There is no doubt but that the railway is responsible."

Second, to the private corporation: "Your corporation, as a very heavy taxpayer, is undoubtedly entitled to protection. However, we do not know as yet how to protect you. The railway people have suggested remedies that we cannot adopt without falling into legal entanglements, while several electrical men have endeavored to scare us into purchasing their patented systems or appliances. If you will engage an electrical engineer, we will assist you in every way into putting his recommendations into effect."

Third, to the water department authorities: "The city holds a $25,000 indemnity bond of the street railway; and that sum will cover any damage that we are likely to sustain for many years."

Fourth, to the various electrical interests: "We are laymen. We do not know anything about this. It would seem that you electrical people ought to be able to correct these little troubles among yourselves."

## The Third Anniversary of the Metropolitan Street Railway Association of New York.

The Metropolitan Street Railway Association, New York, celebrated the third anniversary of its organization at Carnegie Hall, Saturday evening, Oct. 7. Mr. H. H. Vreeland, president, addressing the members of the association and their invited guests, said that the object of the association is to secure its members free medical attendance and $150 for their families in case of death, at an expense of 50 cents per month per capita. In three years its membership has increased from 100 to 2630 members, and the financial condition of the association is fairly satisfactory. It has, during the past two years, formed a very fine library for its members and their families and if any member wishes a technical or engineering book for his own or one of the family's use, which is not already in the library, it will be purchased upon request.

Continuing, Mr. Vreeland said: "At a time like this when there is so much misleading talk indulged in concerning the evil effects to workingmen of large combinations of property, it is well for us to study our own case and inquire what the effect of combination has been upon us. It is, of course, no part of our duty to here discuss the affairs of any other class than our own. We are railroad men, pure and simple, and we must regard movements and tendencies as they affect ourselves and our business. Probably in no industry in the world has consolidation been more active in the last 10 years than in railroads. In fact, railroad history of that period is one continuous record of 'combinations,' 'amalgamations,' 'mergings,' 'leasings,' or whatever terms lawyers please to give to one and the same thing. In the nine years since 1890, 946 railroads, aggregating 63,000 miles, have been consolidated.

"None of the eloquent gentlemen whose prerogative it is to interest themselves in every one else's business will claim that by reason of this consolidation the number of railroad employees in the United States has been lessened, or wages reduced. It is true

these consolidations have saved millions of dollars paid to high-class and ornamental officials, but so far as the operating and working forces are concerned (and with this we are most interested), the effect has been good. Within the period named, hours of labor have been lessened and wages increased, and in that time the number of railroad employees has grown, not alone by reason of extended mileage, but because even the so-called labor-saving improvements have called for more human help. I think it is safe to say that in every instance where an improved appliance has displaced one man, the demand for greater safety and improved facilities has created a demand for two.

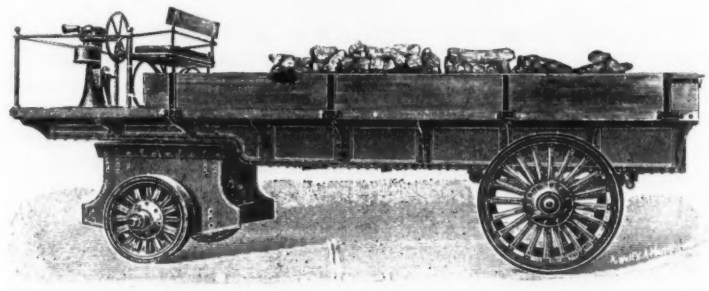
"Nothing will bring the fact home to your minds more surely than a glance at the past and present of the railroad system on which you are employed. Do you find that the introduction of electricity as a motive power instead of horses has increased or diminished the working forces on the street railways which constitute the Metropolitan system? That system as now consolidated has a wage-list ten times as great as that when its constituent properties were operated separately and by horses. Nor is this all, for with every increase in the volume of the list of paid operators, there has been a marked improvment in the personnel and in the standard of the men. No one who knows the truth would, for instance, think of comparing the employees of this system with the rag-tag and bobtail that constituted the working force of its constituent parts or companies when they were separately operated by horse power. The effect of consolidation upon us has been to elevate out of the slough of what is contemptuously called 'miscellaneous labor' between five and six thousand men into a distinct class, in which not only muscle but brain is demanded.

"New York City represents but a small portion of the mileage of street railways under electrical operation in the United States, and it is known to every one of you that any man who has been trained on this system and whose character is good, can claim a place and obtain a standing by the very reason of his apprenticeship here, on any system anywhere in the world. So then, so far as we are concerned, we can look without any special discomfort at a combination whose results have been beneficial to us."

The immense audience which crowded the spacious hall were evidently in accord with Mr. Vreeland's remarks, judging from the hearty applause which followed. After the reading of the secretary's report, a committee ascended the platform and presented a very handsome loving cup and a set of resolutions, formed and framed as an expression of the high esteem which the employees of the Metropolitan Street Railway Company have for their president. Mr. Vreeland acknowledged the gift in a few well-chosen words. A high-class vaudeville entertainment followed which was thoroughly enjoyed by all present.

## A German Electric Dray.

The accompanying illustration shows an electric dray of German manufacture, the maker being Paul Schutze, of Oggersheim, Pfalz. It is equipped with a series motor, and the driving mechanism is attached to the front wheels. The dray is capable of turning curves of a radius, it is claimed, equal to the distance between wheels. The



ELECTRIC DRAY.

speed is from 3½ to 6 miles per hour, according to the load. A grade of 10 per cent. can be ascended with certainty, though naturally at a slow speed. The battery, which is guaranteed by the makers for ten years, can be charged in two or three hours. To go ahead, the controller cylinder is turned to the right, and to the left in order to back. The vehicle is equipped with two incandescent lamps in reflector lanterns, a signal horn and a small kit of screwdrivers, keys, etc. The battery consists of Colonia accumulators, furnished by Leffler & Co., of the Colonia Accumulatorenwerke, Aix-la-Chapelle, and has a capacity of 200 ampere hours. The vehicle is about 20 feet in length over all, and it is stated that it will carry a load of 10 tons.

## CURRENT NEWS AND NOTES.

*DR. A. E. KENNELLY,* of Philadelphia, president of the American Institute of Electrical Engineers, will visit Purdue University, at LaFayette, Ind., during the coming week and lecture before the School of Electrical Engineering on "Ocean Telegraphy."

*THE CLEVELAND STREET CAR BOYCOTT.*—The struggle between the Big Consolidated Street Railway Company, in Cleveland, and its striking employees, was brought to a close on Oct. 3. The boycott on the cars of the company was then declared off, and the long strike was thus practically ended.

*DIATTO TRACTION SYSTEM.*—Our Paris correspondent reports that a contract has been completed with the owners of the patents of the Diatto electric traction system for the use of that system on all of the lines of the Compagnie Generale de Traction, which include 60 miles of railway track.

*ROBBED OF HIS ELECTRICITY.*—In a paper on electrolysis from electric railway currents read before the recent Toronto Convention of the American Society of Municipal Electricians, an incident was related of a Brooklyn man who entered a protest against bonding water pipes to track rails. His electricity, he said, came off the water mains along with the water, "and the city hasn't any right to hook wires on the water pipes and the tracks and damage poor people to help big corporations."

*NO CONSOLIDATION OF AUTOMOBILE COMPANIES.*—The consolidation of automobile companies which, it was announced a few weeks ago, would be completed this month, it is stated has fallen through. The movement was being conducted by Frank A. McGowan, of Trenton, N. J., and was to take in four companies. The capital stock of the projected company was $10,000,000, and the financial part of the deal was to have been done by the Guaranty Development Company. At their office it was said that they had refused to carry out their part of the transaction on account of the high prices at which the options had been secured. The options expired some time ago, but were renewed until the first of this month. No attempt was made to obtain a renewal, and it is understood that the plan has been completely abandoned. The automobile companies which were to be consolidated used gasoline as the fuel for the motive power, and the scheme was not in any way connected with any of the electric automobile consolidations said to be pending.

*A 72 PER CENT. GRADE.*—A new application of electric power is being made at Weehawken, N. J. Elevators are now being built which will hoist foot passengers, wagons and street cars from a point near Nineteenth street, Weehawken, to the summit of the bluff at Mountain road. A cut has been made in the face of the bluff to a depth of forty feet on the south side and twenty-five feet on the north, the difference being due to the conformation of the bluff at that point. On the lower level a concrete base is nearing completion. Its surface expanse will be fifty feet square, and it is designed to support the steel girders which will sustain the incline till the upper platform is reached. The gradient will be a rise of seventy-two feet in every one hundred feet horizontal, making the steepest incline on which cars are operated in the world. The width of the sunken path is forty-six feet, and the cars to move within its walls will completely fill it, being each twenty-three feet wide. The cars will weigh twenty tons each, and will have a capacity of more than twenty tons. The elevators will be triangular in form, the shorter of the sides being formed by the supports necessary to maintain a level floor. They will each be operated by three cables, one of which will be in reserve as a safety precaution. An automatic brake will operate in connection with the safety cable, insuring immunity from accident. The cars will move independently of one another. The power will be obtained from the new power house of the North Hudson Electric Railway Company.

*TELEPHONE BETWEEN PARIS AND ROME.*—It is reported that negotiations have been opened for the establishment of a telephone system from Paris to Rome, and from Paris to Milan.

*ELECTRIC LIGHT IN BUENOS AYRES.*—A despatch from Buenos Ayres, Argentine Republic, states that the city council will shortly annul the clause in electric tram concessions making street lighting obligatory, and will impose a more equitable tax in its place. This clause, the despatch states, has put a stop to all electric tram construction work for the time being.

*INTERNATIONAL CONGRESS OF APPLIED MECHANICS.*—Among the many international congresses to be held in connection with the Paris Exposition of 1900, is one on applied mechanics. Among the subjects to be discussed are mechanical laboratories, application of electricity in mechanics, high-speed steam engines, the mechanism of the automobile, machine tools, etc. The congress will open July 19, and be in session one week.

*SUPPRESSION OF SPARKING.*—An interesting patent was issued Oct. 3 to Charles L. Buckingham and Emil Germann, on a method for preventing sparking at contacts in circuits including electromagnets or other inductive coils. The method consists in having on an electromagnet, for example, a "dead" winding short-circuited on itself. One of the illustrations shows a pair of wires wound together on an electromagnet, one of which is short-circuited on itself and the other going to line. It is stated that by this means the spark at the contact may be almost wholly eliminated.

*ACCUMULATOR TRACTION AT PARIS.*—The Compagnie Generale des Omnibus is making preparations to substitute on its lines vehicles deriving their propelling power from storage batteries. There will be a central station at Montreuil of 2000-kw capacity, though for the present only 1600-kw will be installed. There will be two charging stations, both situated in Vincennes. The generators will be driven by Laval steam turbines. Tudor storage batteries will be used in one charging station and Blot batteries in the other.

*THE PACIFIC CABLE.*—A special despatch from Montreal of Oct. 5 says: Lord Strathcona and the Earl of Aberdeen have been appointed Canadian members of the board of control of the new Pacific cable. Australia has three members, and Great Britain three. The board will now proceed to invite tenders and make financial and other arrangements for the completion of the project. It is expected that the selection of Lord Aberdeen will enlist the sympathies of the Liberal opposition in Great Britain, in which party he has resumed his former active membership.

*HONOLULU ELECTRIC RAILWAY.*—The first section of track for the electric railway in the Sandwich Islands was laid by the Honolulu Rapid Transit Company Sept. 9. It appears, however, that the track laid is not to be permanent, having been put down to prevent the present horse railway company from laying a double track on the same streets. The first-mentioned company has secured a franchise for an electric railway, but its rights are contested by the company now operating the horse railway. The sympathies of the people are reported to be entirely in favor of the new company in their efforts to give better electric traction.

*GAS ENGINES IN IRON MILLS.*—The Pennsylvania Malleable Iron Company contemplates the erection of a large manufacturing plant at McKees Rocks, in which gas engines will be used exclusively for power. It is stated that the company has ordered six 60-hp Otto gas engines. The plant will be the best of its kind in the world, as every modern improvement will be adopted, and its annual capacity will be 20,000 tons. It will be equipped with electric cranes, and conveyors will be installed, thus doing away with a great deal of labor in handling materials and product. This concern will furnish 8000 tons of malleable castings per year to be used in steel car construction, for which vehicles there is a large demand.

*THE BOSTON ELEVATED RAILWAY.*—A section of the Boston Elevated Railway, following the bend in Washington Street south from Castle Street, is now in a practically completed state The next section to be set up will be that for the City Square at Charlestown, all the material for this section being now on hand. About 100 feet of material can be placed in position and tracked during a night, the riveting being done in the daytime. The construction of the power plant at Lincoln's wharf will soon be commenced. Work on this has been delayed in order not to encroach upon the accommodations at the wharf of the two lines of steamboats engaged in the summer excursion traffic.

*INCANDESCENT LAMPS OF SMALL CANDLE-POWER.*—The French Société d'Encouragement des Industries Nationale some months ago offered a prize for the best lamp of 2-cp, the voltage to be 100. One of the conditions of the test was that the lamp should have a life of at least 400 hours. Lamps were offered by three manufacturers in competition for the prize, but the committee appointed to undertake the tests did not make an award for the reason that only one lamp had a life outside the minimum period. Each of the competitors, however, was given a silver medal in view of the excellence of the lamp presented in other respects than life. New propositions have been made in which the life is fixed at a minimum of 500 hours as a mean of five lamps tested. The prize will be awarded in 1901.

*THE MONTREAL Y. M. C. A. ELECTRICAL CLUB.*—The Y. M. C. A. Electrical Club of Montreal recently gave its first annual dinner, Mr. Fred B. Horn, president, presiding. Prof. Herdt, of McGill University, responded to the toast "Electricity." The secretary, Mr. D. A. Budge, gave an account of the growth of the evening classes of the Y. M. C. A. Association since their inception fifteen years ago. The various associations in the United States and Canada are now giving instruction to from 30,000 to 35,000 members. Mr. J. C. Bray, secretary of the Electrical Club, gave a résumé of the summer's work, which included lectures on "The Theory of the Telephone," by Mr. Fred B. Horn; "Interior Wiring," by Mr. T. F. Pickett; "The Electric Motor," by Prof. Herdt. Visits were made to the electrical plants of the Royal Electric Company, Montreal Street Railway, the Lachine Rapids & Hydraulic Company and the Standard Light & Power Company.

*STEALING ELECTRICITY.*—A singular decision has been made in the Senate of the Supreme Court of the Empire of Germany. Last December three mechanics attached a wire to a cable laid in the house where they lodged, and stole electricity enough to light their rooms. The Provincial Court sentenced them each to one day's imprisonment. The decision was based on the principle that electricity possessed the essential properties of a movable object. It has gone from court to court, and now the Senate holds that the judgment of the Provincial Court must be quashed on the grounds that the law provides only against the theft of movable bodies, and the court holds that those properties are wanting in electricity which would be necessary to constitute it a movable object in the sense of the law. The sentence states that electricity must be regarded as one of the energies of nature, like sound, light and elasticity. It was also decided that damage to property cannot be pleaded, for that requires that the substance of the object must be affected. Again, it was held that property has been withdrawn from the wire, but the Senate denies this, for electricity is not one of the properties of copper wire; so it is unanimously concluded that the law as it is in Germany in tapping an electric current is not theft.

*NEW METHOD OF FORMING STORAGE BATTERY PLATES.*—A patent was issued Sept. 19 to Henri Rathier, of Paris, France, on the formation of storage battery plates. The perforated grid is composed of an alloy of 85 per cent. of metallic lead and 15 per cent. of antimony. The plates are first immersed for about an hour in sulphuric acid of a density of 40 Baume, which, it is stated, imparts to the plate a greater electric retentivity, strength and life. After this operation the perforations in the positive plates are filled with the usual red lead paste, and the negative plates with a paste consisting of five parts of litharge and one part red lead. After being submitted to pressure in a hydraulic press and dried, the plates are dipped in sulphuric acid of 30° Baume, just long enough to thoroughly saturate the paste with the acid, taking anywhere from one to five minutes; when the plates are withdrawn, any lumps or swellings that may have been formed are removed with a scraper. The plates are then set up in an electrolyte and formed as usual. The inventor states he has found by experiment that the pickling or soaking of the plates in acid of the strength above mentioned before and after the application of the lead oxide paste, gives the plates a longer life and much greater intensity and equality of force.

*CONTACT ELECTRIC RAILWAY SYSTEM.*—In a patent issued Oct. 3 to Emile Bede, Brussels, Belgium, a contact system of electric traction is described. At intervals of about 6 feet, the lead-covered cable carrying current to the motor has attached a funnel-like tube in which there is a contact piece secured to a rubber stopper in the mouth of the tube. As a shoe on the car passes over these boxes, it presses on a metallic button over the stopper. The elasticity of the rubber causes the contact piece to come into contact with the cable, thereby closing the circuit between the source of current and the shoe. When the pressure of the shoe is removed, the elasticity of the rubber stopper causes the contact to be broken.

# LETTER TO THE EDITORS.

## Deri Patent on Balancing Coils.

*To the Editors of Electrical World and Engineer:*

Sirs:—Permit me to reply in all brevity to the remarks of Mr. M. E. Thompson relating to my U. S. patent, No. 630,492, which remarks appeared in your paper of Aug. 26.

It is not correct that the subject of my patent is identical with the patents of Prof. Ryan, which patents are well-known to me. They are essentially and entirely different. Common to both is only the fundamental principle of balancing coils. This principle is just as little the property of Prof. Ryan or Mr. Thompson as it is mine. These gentlemen have themselves in their patent papers mentioned this principle as previously well-known.

It is also not correct that it is impossible to tell by my descriptions how the machine is actually constructed. On the contrary, any expert is made fully acquainted with the practical construction by my diagrams. It is clear that the usual construction of machines is suitable for the purpose without any alterations, and I have myself constructed the machine in this simple form—contrary to the complicated construction which Messrs. Ryan and Thompson have published.

To the remarks addressed to the U. S. Patent Office, which emphasize the distinctions between domestic and foreign inventors, I do not care to refer. I only wish to mention that in the Austrian and Hungarian Patent Office—according to law and custom—the foreign inventors enjoy the same rights and privileges as the subjects of these countries.

Concerning the few remarks which, as I understand the article, refer ironically to me personally, I think I can pass over them, as I take it for granted that to gentlemen of our profession my name is to some extent known in a serious capacity.

VIENNA, AUSTRIA. MAX DERI.

# DIGEST
OF
# CURRENT ELECTRICAL LITERATURE.
By CARL HERING.

### DYNAMOS, MOTORS AND TRANSFORMERS.

*Single-Phase Alternating Current Motor.*—A note stating that Rhodes has invented a new single-phase induction motor, which starts with a torque approximately equal to that exerted at full load. An experimental 1-hp motor gives a starting torque of 21 lbs. on a 3-inch pulley, the full load torque at a speed of 2200 revolutions per minute being 20 lbs. The full load efficiency of the motor on a 100-volt 80 frequency circuit is stated to be 75 per cent., the power factor is 0.70. No further particulars are given.—Lond. *Elec. Rev.*, Sept. 22.

*Small Motor Generator.*—SOULIER.—An illustrated description of a small motor generator devised by Legros and Meynier with two windings, one being supplied with a continuous current at 110 volts, the other furnishing a continuous current at lower voltage, necessary for charging a battery of 3 to 5 cells. The primary winding is an ordinary drum winding and the secondary a single coil which generates redressed currents like the old Siemens machine, having a commutator with two bars and two brushes. The weight of such a motor generator suitable for the charging of 3 to 5 cells is 21 lbs. It can be used for many purposes as for galvanoplastics and electrolysis, and is especially suitable for the ignition of the explosive mixture of petroleum motors.—*L'Ind. Elec.*, Sept. 10.

REFERENCES.

*Parallel Connecting of Alternators.*—GUILBERT.—An article discussing graphically the following question: When any two alternators are connected in parallel and the pressure at the terminals is kept constant, how do the induced e. m. fs., the currents and the powers vary, if one of these values varies?—*L'Eclairage Elec.*, Sept. 2.

*Sparking of Continuous Current Machines.*—FISCHER-HINNEN.—A list of some errata in the French translation mentioned in the Digest Oct. 7.—*L'Eclairage Elec.*, July 22.

*Fly-Wheel Power of Motors.*—SCOTT.—A reprint of the article noticed in the Digest Sept. 30, under Iron Wire on Armatures. (The name of the author was inadvertently omitted in that abstract.)—*El'ty*, Sept. 27.

*Overcompounding Dynamos.*—SCOTT.—A reprint, with the illustrations of the article noticed in the Digest Oct. 7.—*El'ty*, Oct. 4.

### LIGHTS AND LIGHTING.

*Three Arc Lamps in Series.*—WEINHAGEN.—An illustrated description of a continuous current differential arc lamp of Weinert, whose voltage is about 35 to 37. If three such lamps are connected in series without any resistance, between mains at 105 to 120 volts, they are said to give a quiet and good light. At 215 to 225 volts, six lamps can be connected in series without external resistances.—*Elek. Anz.*, Aug. 17.

*Nernst Lamp.*—A note which is said to be based on authentic information, stating that neither the time when the lamp will be introduced commercially, nor its price, have yet been decided upon. The lamps will be manufactured for 220 volts and for 25 and 50-cp; the 25-cp lamps will be adapted for being lit from an external source, or automatically by a heating coil; the 50-cp lamps will all be automatic. The life is claimed to be at least 200 hours, in which time there is neither a decrease of candle power nor an increase of watts; the watts are about 1.5 per candle.—*Elek. Anz.*, Sept. 3.

REFERENCES.

*Forerunners of the Nernst Lamp.*—FODOR.—The beginning of a translation of the article noticed in the Digest May 6.—*Elec. Rev.*, Sept. 27.

*Illumination of the Brooklyn Bridge.*—An illustrated description of the method of constructing and wiring the huge letters in the words "Welcome, Dewey," in the recent celebration, which contains 8000 incandescent lamps.—*Sc. Am.*, Oct. 7.

### POWER.

*Electrical Machinery on Board Ship.*—SIEMENS.—A British Association paper giving a history of the subject and urging the use of electricity for lighting and all auxiliary power purposes on shipboard. In the discussion which followed Sir Wm. White, the chief constructor to the English Admiralty, did not admit the claim of any one form of power to be the best for all purposes. They use an auxiliary steam plant for the steering gear and hydraulic power for handling the large guns. The use of electricity in the English navy is, however, growing. At present electricity is used for guns up to 9.2 calibre.—Lond. *Elec. Eng.*, Sept. 22; abstracted in Lond. *Elec.*, Sept. 22.

*Parsons Steam Turbines.*—A paper of Parsons' on high speed channel steamers, read before the British Association, elicited a discussion which brought out some information concerning the use of steam turbines for electric purposes. The engineer of the Cambridge electrical plant, said that he had had charge of 15 steam turbines of 1000-hp for six years and found that they had great endurance; also that the cost of maintenance was small. Mr. Parsons said that an accurate estimate of the steam efficiency gave as the best result 16 to 17 lbs. per electrical hp-hour.—Lond. *Elec. Rev.*, Sept. 22.

REFERENCES.

*Power for Mining Purposes.*—GARFORTH.—A short article on the

well-known comparative advantages of electricity, steam and compressed air for mining purposes (see Digest July 15, Aug. 19, etc.), and of the comparative advantages of polyphase and continuous currents.—*Cassier's Mag.*, October.

*Battleship Kearsarge.*—A brief description of the electrical features of this battleship, which is said to be the first in the world to be provided with a complete electrical power transmission plant.—*Elec. Rev.*, Sept. 27.

*Transmission and Distribution by Alternating Currents.*—Leblanc.—The continuation of his very long paper (Digest Jan. 7, April 29). In the present part he continues to discuss redressing transformers and describes the system used by the Chemin de Fer du Nord.—*Bul. Soc. Int. des Elec.*, July.

*Transmission and Distribution of Energy.*—Leblanc.—The continuation of his very long serial, Digest Jan. 21, 28, March 4, April 1. Redressing transformers are discussed.—*L'Eclairage Elec.*, Sept. 16.

### Traction.

*Storage Battery Locomotives.*—A short illustrated description of the storage battery locomotive used by the Lyons Co., in France, since 1897 (presumably meaning the Paris, Lyons & Mediterranean R. R.). The machine has three axles, of which two are drivers, each with a gearless electric motor. The machine has about one-half the power of the ordinary express steam locomotives on this road, but it is only necessary to double the number of driving axles (and presumably the motors also) to bring it up to the full power. It is connected to a tender carrying the accumulators, the hauling of which absorbs a great part of the power generated on account of its weight of 100,000 lbs. There are 192 cells having a capacity of 1000 amp.-hours at an average rate of discharge of 500-amp. The electrodes of one cell weigh 200 lbs. The locomotive itself carries 18 accumulators of 1500 amp.-hours, to excite the fields of the motors and to furnish the current for the lighting and for the compressed air necessary for the Westinghouse air-brakes, the whistle and the starting apparatus. (References to other descriptions of what is presumably the same locomotive have already been given in the Digest.)—*St. R'y Rev.*, September.

*Electric Trunk Railroad in Italy.*—A note stating that in the autumn of this year the trunk railroad from Bologna to San Felice will be operated electrically with accumulator cars. The distance is 26 miles and the maximum grade 6 per cent. With a maximum speed of 50-km per hour the round trip, with a stop in San Felice, can be made in three hours. For normal traffic two cars will be used, each having a battery of 288 Pescetto accumulators, the capacity being 200 amp.-hours if discharged down to 1.8 volts. The energy of the battery is sufficient for 62 car miles, hence amply sufficient for a round trip. The weight of the battery is 16,500 lbs.—*Elek. Anz.*, Aug. 27.

*Weight of Accumulators for Traction.*—Rosset.—A theoretical article, illustrated by diagrams, calculating analytically a general formula for the weight of accumulators necessary to drive an automobile or a motor car over a given distance, as a function of this distance. From this formula (which is far too complicated to be used in practice) he draws the following interesting conclusions. The weight of accumulators is proportional to the weight of the car with passengers, but without the battery, and increases rapidly with the distance. It is impossible to surpass a certain maximum distance without recharging the battery, whatever the weight of the car without battery may be. The curve of the efficiency in the diagrams shows that it is not economical to go over a large distance, without recharging, hence the advantage of recharging stations at as small distances as possible. He shows that in some cases it may be more economical to drive over a longer roundabout way, having a good pavement, instead of going the direct road over a bad pavement (as every bicycle rider knows from experience); a graphical method of representing this relatively, is given.—*L'Ind. Elec.*, Sept. 10.

*Electric Automobile.*—Hanchett.—An illustrated series of short practical remarks. The motors on automobiles should be shunt wound, there being no better method of breaking them to drop the controller off a notch or two and with the motors acting as dynamos turn the surplus energy back into the battery; full field strength should be used at all times; the field coils may be divided into as many sections as batteries, and each battery given a section. He recommends the automobile clubs to study the automobile traction coefficients. He then discusses the power consumed by the pressure on the bearings and gears, air friction and tire contact, the last one being the most important, so that it is necessary to be very careful in the selection of tires. An electric brake is described and illustrated, and the weight and cost of electric automobiles is discussed. As in general the storage battery represents very closely one-half the weight of the vehicle, for every pound of equipment installed on the vehicle, a pound of storage battery must be added to carry it; therefore light motors, controllers, bodies and trappings should be used for automobiles, which is a reason for the high price, as new designs are necessary.—*The Automobile*, September.

*Automobile Omnibus.*—Siebert.—A long illustrated description of the automobile omnibus of Siemens & Halske, referred to in the Digest Aug. 5, which is specially adapted for connecting street railways through parts of a city where it may not be practicable to lay rails. At the beginning and end of the regular trip it runs on rails and for the intermediate part on the pavement of the streets. While running on rails, it takes current from the overhead wire, both for running and charging a battery of 200 accumulators of a capacity sufficient for a run as automobile over 3½ miles. The weight of the omnibus without passengers, but with the battery, is 14,300 lbs.; the weight of the battery is 3300 lbs.—*Elek. Zeit.*, Sept. 21.

*Electric Railroads Operated by Gas Engines.*—A short description of a branch line of the Long Island Railroad, using three 50-hp gas engines of Westinghouse design, at the power house. A storage battery of 265 cells is used in connection with the 550-volt dynamos and connected directly in multiple with the dynamos, without a booster; the dynamos have special combined windings, by means of which their voltage is made to fall off as the load rises to such an extent that the battery will take the greater part of the load fluctuations. This is one of the first roads to be run by gas engines, and thus far the trial has been very satisfactory. The working expenses, including wages of motormen and conductors, are 13 cents per car mile, which may be regarded as good for a road on which only three cars are in service and for most of the time only one.—*R. R. Gaz.*, Sept. 29.

*Electric Elevated Railways.*—Davis.—He shows the immense developments of electric railways, and believes the elevated railway will be the type of the future, like the one to be built between Liverpool and Manchester; he claims a lower cost of operation and positive safety from accidents; he discusses the prospects of such a line from New York to Chicago, the trip to be made in 7 hours at 100 miles per hour. There are also some skeptical editorial remarks.—*R'y and Ship. Wor.*, September.

*Electric Tramways in China.*—A short note stating that the first electric tramway was recently opened in China. No technical particulars are given.—*Elek. Zeit.*, Sept. 21.

### References.

*Calculation of Electric Tramways.*—Fekl.—A long theoretical article starting from the curves which represent the current and the speed of the motors as functions of the torque or pull. He describes a graphical method of finding the current and speed of the motors for any grade, from these curves; also the speed of the train. He calculates analytically and with the aid of diagrams the ampere hours per motor mile or train mile, the average current and power, and the average loss of pressure.—*Zeit. fuer Elek.*, Aug. 13, Sept. 3.

*Electric Traction in Paris.*—A long illustrated description of the electric installations of the Gare d'Anvers-Est, from two papers of Hoest and Melotte. The power house in Berchem about a mile from the central depot, the switchboard, the storage battery consisting of 183 Tudor cells of 1200 amp.-hours, the boosters and the hydroelectric elevators are described.—*L'Eclairage Elec.*, Aug. 19.

*Railway Statistics for Austria.*—A statistical table for the electric tramways in operation Dec. 31, 1898. Also one of the traffic of the electrical tramways of Austria, Hungaria and Bosnia from April to June, '99, and a comparison of the traffic and of the gross receipts in 1898 and '99.—*Zeit. fuer Elek.*, Aug. 20.

*Bombay Tramways.*—A description of the tramways in Bombay, India; no techincal information is given.—*St. R'y Rev.*, Sept. 15.

*Automobile Accumulators.*—Bainville.—A brief description of the apparatus which was used in the recent competitive accumulator tests in France; also some tables giving the results for four weeks of the tests; it simply gives the charge and discharge and the energy efficiency, the type of accumulator being merely referred to by letter. Up to that time 9 out of 16 of the batteries which are competing, have failed. It is thought that the test is more severe than the requirements in practice.—*L'Elec.*, Sept. 9.

*Accumulators for Automobiles.*—Reyval.—An illustrated series of articles; the present portion refers to the accumulators of Bouget,

Carein and Schivre, Blot-Fulmen, Osburn, Phœbus and Ramon du Sonza; tables of data are given.—*L'Eclairage Elec.*, July 22, 29, Sept. 2.

*Terminal Boxes for Recharging Accumulators.*—A well illustrated description of the two terminal boxes, for local recharging stations for automobiles, which received the prizes in the recent French competition.—*L'Ind. Elec.*, Sept. 10.

*Automobile Truck.*—An illustrated description of the Fisher automobile truck, in which the Patton system is used (see the article of Hospitalier in the Digest Sept. 16); a gasoline engine drives a dynamo for generating the current for charging a storage battery which drives an electric motor.—*The Automobile*, September.

*Electric Automobile.*—An illustration, with a short description, of the Chapman electric vehicle.—*Sc. Amer.*, Sept. 30.

*Automobile Street Sweeper and Sprinkler.*—An illustrated description of an accumulator automobile used in Paris for street sweeping and sprinkling. The wheels and the sweeping machine are coupled to the electric motor. The pump is operated electrically.—*Sc. Amer. Sup.*, Oct. 7.

*Berlin Motor Car Exhibition.*—The first part of an illustrated description of the motor cars exhibited there. An electric victoria, a coupé and a 10-ton electrical wagon are illustrated.—*Ind. and Iron*, Sept. 22.

A somewhat longer illustrated description of this exposition which was referred to in the Digest Oct. 7. There was an electric automobile tricycle with a primary battery; lead accumulators are used in the other electric automobiles.—*Elek. Anz.*, Sept. 17 and 24.

### Installations, Systems and Appliances.

*Lighting and Power Plant in Linden.*—A long abstract of the annual report of the municipal electric plant of Linden, Germany, which furnishes current for lighting and power purposes. Two generators each of 60-hp are coupled direct with two dynamos, generating current of 160 amperes at 250 volts. An accumulator battery of 200 cells has a capacity of 960 amp.-hours, the current being 220-amp. for charging and 320-amp. for discharging. The three-wire system at 2 × 110 volts is used. The smaller shops seem to be becoming familiar with the use of electric motors, 35-hp being used for driving motors in 15 butcher shops and 75-hp in 31 other trade shops. The installation is to be extended.—*Elek. Anz.*, Sept. 24.

*Triberg Electric Light and Power Installations.*—A long illustrated description of the installation which supplies Triberg and some neighboring towns in the Black Forest in Germany, with electric light and power. There are four power stations, the available water power being about 600-hp. In the oldest station three-phase alternating current at 5000 volts is generated, while the other three stations generate continuous current, the dynamos being driven partly by water power, partly by three-phase alternating current motors fed from the oldest station. These three stations also have accumulators.—*Elek. Anz.*, Aug. 20, 24; Sept. 3, 10.

*Municipal Trading.*—Donald.—An abstract of a British Association paper. A comparison between 21 English municipal and 21 English company undertakings of electrical supply gives the following result: Cost of production per unit: Municipalities, 3.74 cents; companies, 5.42 cents. Average price per unit to consumer: Municipalities, 9 cents; companies, 11 cents. Profit on mean capital: Municipalities, 7¼ per cent.; companies, 7½ per cent.—Lond. *Elec. Rev.*, Sept. 22.

REFERENCES.

*Problem of Municipal Ownership.*—Gemunder.—A reprint of his address before the League of American Municipalities.—*El'ty*, Sept. 27 and Oct. 4.

*Austria.*—The first half of an account of the use of electricity for lighting and power purposes in Austria in 1898, based upon the reports of the Boards of Trade.—*Zeit. fuer Elek.*, Sept. 24.

*Current Distribution in a Plant.*—Baxter.—An illustrated article giving practical hints showing how to arrange the current distribution in a large electric plant systematically.—*Amer. Mach.*, Sept. 28.

*Storage Batteries.*—Adams.—A short article pointing out that the storage battery is well suited to displace small isolated steam plants.—*Cassier's Mag.*, October.

*Resistances.*—Levy.—An illustrated paper read before the Union of German Electrical Engineers, describing resistances consisting of flat bands which are fixed in zig-zag form upon cast iron plates by means of insulating enamel. He claims that there is a considerable saving of weight and space.—*Elek. Zeit.*, Sept. 21.

### Wires, Wiring and Conduits.

REFERENCES.

*Underground Wires in Toledo.*—An illustrated description of the underground wiring of the Toledo Traction Co., which also does the commercial lighting.—*St. R'y Rev.*, Sept. 15.

*Aluminium Wire Joints.*—A reproduction of the illustrations of the joints made in Germany, mentioned in the Digest Oct. 7.—*Elec. Rev.*, Sept. 27.

### Electro-Physics and Magnetism.

*Thermo-Electricity.*—Barrett.—A brief abstract of a British Association paper on some novel thermo-electric phenomena.. A thermo-electric couple was composed of a junction of steel with an alloy of 68.8 per cent. iron, 25 nickel, 5 manganese and 1.2 carbon. On increasing the temperature from ordinary values to about 1100°, it was observed that the e. m. f. rose to a maximum at 300°, then gradually followed a wavy line, being almost steady from 300° to 500°, falling, then rising and falling again. For a copper steel couple the neutral point varies with successive heatings and coolings. These effects are independent of the rate of heating or cooling, but oxidation has some effect in altering the neutral temperature of the copper-steel couple.—Some other descriptions of what appears to be the same element, were noticed under units, measurements, etc., in the Digest June 17 and July 15.—Lond. *Elec.*, Sept. 22.

*Thermo-Electricity.*—Holborn and Day.—An account of a very precise experimental investigation made in the German Reichenstalt. They studied the e. m. f. of thermoelements as a function of the temperature between 0° and 1300°, and found in general a surprising agreement with the law of Avenarius that the e. m. f. of a thermoelement expressed as a function of the temperature, approximates very closely to a parabola. This agreement is in general so good that the failure of the law to apply beyond these limits is to be regarded as an evidence of some change in the condition of the metal investigated at that point, perhaps due to the absorption of gases. The results of the measurements are given in a table.—*Amer. Jour. of Sc.*, October.

*High Rate Röntgen Tubes.*—Walter.—In order to obviate the melting of the platinum cathode in a Röntgen ray tube, which occurs in about half a minute when the Wehnelt interrupter is used, he constructed a tube in which the anti-cathode was attached to the bottom of a cone of iron or other metal, the upper end of the cone being connected to a metallic rod projecting outside of the tube into a flask filled with water. The water is heated and soon begins to boil, but in any case, its temperature, and hence also that of the anti-cathode, never exceeds 100°. The flask is carefully insulated and cemented to the wall of the vacuum tube.—*Fortschritte der Röntgenstrahlen*, Vol. 2; abstracted in Lond. *Elec.*, Sept. 22.

*Masses Smaller Than Atoms.*—J. J. Thomson.—A very brief notice of an interesting British Association paper. From experimental researches he concludes that the particles in a cathode stream and similar phenomena, have masses which are only a small fraction of that of the atoms of hydrogen. He regards the act of positive electrification of an atom as the removal of tiny negatively charged corpuscles or "electrons" from the atom, while the act of negative electrification consists in the corpuscle being added to an atom. Thus the mass of an atom is not to be regarded as being of fixed value, as it may vary either way by the small mass of an electron.—Lond. *Elec.*, Sept. 22.

*Atmospheric Electricity.*—Foveau de Courmelles.—In a communication he points out that the air and sand friction produced by the sirocco in the Sahara in Africa, must cause static electricity, and describes some phenomena observed there during a violent sirocco. Everything seems to become a condenser and there are discharges by sparks, and electric effluvium phenomena emanating from points. During a sirocco the odor of ozone was observed and disappeared with it.—*Cosmos*, Sept. 23.

*Globular Discharge.*—Doublet.—A communication stating that the experiment of Leduc (Digest, Sept. 2) can be made and even succeeds better, without the plate of metal under the sensitive plate. He thinks the phenomenon is due to electrolysis.—*L'Eclairage Elec.*, Sept. 9.

*Electric Charges in the Arc.*—Cheneveau.—A short article on experiments which were intended to show that in the continuous current arc, electric charges exist in the vapors around the poles and that they change their signs when those of the electrodes change.—*L'Eclairage Elec.*, Sept. 16.

*Magnetic Transformation of Iron.*—Le Chatelier.—He does not

think the observations of Curie and Osmond are conclusive; he thinks that in iron as in nickel, the transformation is a progressive one.—*Comptes Rendus,* July 31; abstracted in *L'Eclairage Elec.,* Aug. 19.

REFERENCES.

*Electrographs of Discharges.*—GATES.—Some good "electrographs" of the electrostatic discharge, made without a camera. He placed an isochromatic plate between the two poles of a static machine while in full action, and directed the spark against the sensitive plate, which was placed within a lightproof envelope, thus allowing the current to photograph its path through the film.—*Sc. Amer.,* Oct. 7.

*Spectra of Oscillating Discharges.*—HEMSALECH.—A long abstract of the paper noticed in the Digest Sept. 16.—*L'Eclairage Elec.,* Aug. 26.

*Explosive Effect of Electric Discharges.*—TROWBRIDGE, MCKAY and HOWE.—An American publication of the paper abstracted in the Digest Sept. 30.—*Amer. Jour. of Sc.,* October.

*Pressure Within the Spark.*—HASCHEK and MACHE.—A longer illustrated abstract of the article noticed in the Digest Sept. 30.—*Elek. Zeit.,* Sept. 21.

*A New Vacuum Phenomenon.*—FOMM.—A French abstract of the article mentioned in the Digest Aug. 19.—*L'Eclairage Elec.,* Aug. 19.

*Cathode and Canal Rays.*—BERG.—An illustrated abstract of the article noticed in the Digest Sept. 16.—*Elek. Zeit.,* Sept. 21.

*Phillips Phenomenon.*—PHILLIPS.—An abstract of a British Association paper on the production in rarefied gases, of luminous rings in rotation about lines of magnetic force. (See Digest July 29, Aug. 12, 26; Sept. 2, 23.)—Lond. *Elec. Rev., Elec. Eng.,* Sept. 22.

*Electricity and Heat.*—VOIGT.—Two articles of a highly theoretical and analytical nature, one on the relations of pyroelectricity and piezoelectricity, the other giving a general thermodynamic theory of the relations between electricity and heat.—*Wied. Ann.,* Vol. 66, p. 1029, 1898, and v. 67, p. 717, April '99; long French abstracts of both articles in *L'Eclairage Elec.,* July 22.

*Velocity of Electric Waves.*—GUTTON.—The complete illustrated paper which was abstracted in the Digest July 29.—*Bul. Soc. Int. des Elec.,* July.

*Terrestrial Magnetism.*—BAUER.—A very brief notice of a British Association paper on recent magnetic work in North America. He made a detailed magnetic survey of Maryland, and now proposes to undertake a less detailed survey of the entire United States. He appeals to the Canadian Government to give aid to a similar survey of the Dominion.—Lond. *Elec.,* Sept. 22.

*Magnetic Charts.*—MARMOR.—An article on terrestrial magnetism and on the Moureaux and Mathias methods of drawing magnetic charts.—*Cosmos,* Sept. 9.

*Magnetic Field of a Tubular Current.*—DE NIKOLAISVE.—A reprint of the French Academy paper abstracted in the Digest Sept. 9. —*L'Eclairage Elec.,* Sept. 2.

## ELECTRO-CHEMISTRY AND BATTERIES.

*Cost of Production of Carbide of Calcium.*—LIEBETANZ.—A paper read before the Acetylene Congress in Budapest, calculating the cost of production of 1000-kg of carbide of calcium with different sources of power. He bases his estimate upon the supposition that 5-kg may be obtained per 24 kw-hours in a well managed carbide factory, or, if the losses in the machines and transmission are considered, that for the production of 1000-kg of carbide in 24 hours there are necessary 445 primary hp. The cost of 1000-kg is estimated at $58.50 for steam power and at $44.50 for water power, or $14 less for the latter. If the freight charges are high, it may be more convenient to produce the calcium at the point where it is to be used, in a steam plant, than to import it from a distant water plant. He adds some remarks concerning the utilization of gases of the blast furnaces. He estimates the loss of energy, resulting from the waste of three gases in Germany in 1897, to be 82,500,000-hp, and says that in the Phœnix plant in Germany a trial is now being made to use these gases as power for the production of carbide ot calcium.—*Zeit. fuer Elektrochemie,* Aug. 10.

*Plating of Aluminium with Silver, Gold, Copper and Nickel.*—LANSEIGNE and LEBLANC.—They give the following receipts for electrolytic baths. For plating with silver, 20 gr. of nitrate of silver, 40 gr. of cyanide of potassium, 40 gr. phosphate of soda, 1000 gr. water. For plating with gold, 40 gr. of chloride of gold, 40 gr. of cyanide of potassium, 40 gr. phosphate of soda, 2000 gr. water. For plating with copper, 300 gr. cyanide of copper, 450 gr. cyanide of potassium, 450 gr. phosphate of soda, 5000 gr. water. For plating with nickel, 70 gr. chloride of nickel, 70 gr. phosphate of soda, 1000 gr. water. The baths are to be heated up to 140° to 158° F. and to be kept at this temperature. The anodes must consist of the same metal, which is dissolved in the bath.—*Jour. de Pharm. et de Chimie,* 9, 77; abstracted in *Elektrochem. Zeit.,* August.

*Electrolysis of Fused Chloride of Zinc.*—SCHULTZE.—An account of an experimental investigation. He found that some sorts of chloride of zinc, as bought in the commerce, if electrolyzed, lose the water of crystallization, which cannot be removed by mere heating. He analyzed the product. The electric resistance of the pure salt, after the water has been removed by electrolysis, is less than that of the salt containing water. The melting point was found to be about 295° C., while other investigations had found 260°. The resistance in ohms per cb.cm. was found to be 0.46 at 700°, 0.28 at 600°, 0.104 at 500°, 0.026 at 400°, 0.00186 at 300°, 0.000006 at 225°.—*Zeit. fuer Anorgan. Chemie.,* Vol. 20, p. 323, 333; abstracted in *Zeit. fuer Elektrochemie,* Aug. 3, 17.

*Electrolytic Production of Crystallized Tungsten.*—HALLOPEAU.—An article stating that crystallized tungsten may be obtained by electrolysis of paratungstate of fused lithium, between platinum electrodes. The crystals obtained had 99.64 per cent. of tungsten.—*L'Eclairage Elec.,* Sept. 9.

*Electrolytic Glycerine Baths.*—MARINO.—A description of a method of preparing electrolytic baths, which he claims will assure good, homogeneous and very adhesive metallic deposits. Instead of water he uses glycerine as the solvent; it is sufficient to dissolve the salts of silver, zinc, copper, aluminium, lead, etc., in the glycerine in the proper proportions. The electrolytic refining of nickel, zinc and copper by this method are described.—*Elektrochem. Zeit.,* August.

*Industrial Production of Hydrogen by Electrolysis.*—SCHOOP.—An illustrated description of his method which is now in operation in the Hirschwang accumulator factory and is said to be satisfactory. The apparatus consists of a lead cylinder as anode which contains the dilute solution; in the middle are four perforated lead tubes as cathodes which have glass tubes at their upper ends, through which the hydrogen escapes. The electrolytic hydrogen is claimed to be extremely pure and odorless. The cost of producing a half-cubic meter of oxygen and one cubic meter of hydrogen chemically is given as 46 cents, while electrically it is 22 cents.—*Elek. Neu. Anz.,* Aug. 1.

*Electrolytic Ozone.*—ANDREOLI.—A short account of the researches of Schoenbein, Soret, Baumert, Le Blanc, Berthelot, Timo and Donovan on the electrolytic production of ozone. He states that this older method has now been replaced in general by the electrostatic method, but suggests that with modern appliances it might now be possible to use the electrolytic method to advantage for certain special applications.—*L'Elec.,* Sept. 2.

*Electrolysis of Hydrochloric Acid.*—TOMMASI.—A reprint of a paper published in 1882 discussing the following two cases: If the acid is concentrated, the platinum anode is attacked by the chlorine and then acts as a soluble anode; if the acid is diluted, there is also a liberation of oxides of chlorine, but the platinum is not attacked.—Lond. *Elec. Rev.,* Sept. 22.

*Solution Tension.*—LEHFELDT.—A short abstract of a British Association paper criticising Nernst's theory of the solution tension, according to which, when a metal is immersed in an electrolyte, a minute amount of it goes into solution in the ionic form, giving a positive charge to the liquid as compared with the metal, or ions from the solution are deposited in metallic form, giving the metal a positive charge, according as the osmotic pressure of the ions in solution falls short of, or exceeds an amount known as the electrolytic solution tension. The amount of metal to be deposited or dissolved is generally supposed to be too small to be measured. By combining the calculated value of the solution tension with the theorems of electrostatics on the tension exerted by electric charges, he claims that in the case of zinc at least, the amount dissolved would be some centigrams per square centimeter immersed, and could easily be weighed.—Lond. *Elec. Rev.,* Sept. 22.

*E. M. F. Between Amalgams.*—CADY.—An account of a large number of measurements which showed that the e. m. f. is independent of the concentration of the salt of the amalgamated metal dissolved in the electrolyte, and also independent of the solvent, in agreement with the theory. The numerical values, however, differed from those calculated from the theory; they were about 6 per cent. smaller for zinc cells and about twice as large for calcium cells.—*Jour. Phys. Chemistry,* Vol. 2, p. 551, 1898; abstracted at some length in *Zeit. fuer Elektrochemie,* Sept. 7.

*Drop Electrodes.*—PALMAER.—An account of an experimental chemical investigation, showing that there are such changes of concentration, as required by Nernst's theory of the drop electrodes. He agrees, however, that his experiments are not conclusive against the theory of Warburg.—*Zeit. f. Phys. Chemie.*, Vol. 28, p. 257; abstracted in *Zeit. fuer Elektrochemie*, Aug. 10. French illustrated abstracts of a former article by Palmaer and of the article by Meyer, noticed in the Digest July 22, are given in *L'Eclairage Elec.*, Sept. 9.

REFERENCES.

*Aluminium Manufacture in Great Britain.*—RISTORI.—A well illustrated description of the factories, their product, and the principal uses of aluminium.—*Cassier's Mag.*, October.

*Manufacture of Ferro-Silicium.*—CHALMOT.—A brief description of his industrial method of manufacturing, containing as high as 50 per cent. of silicium and in use in several American manufactories; he uses the electric furnace. The original was given in the *Am. Jour. of Chem.*—*L'Eclairage Elec.*, Sept. 2.

*Calcium Carbide Industry.*—KERSHAW.—Some statistical data concerning recent progress in the calcium carbide industry and a record of some recent publications on this subject.—Lond. *Elec., Rev.*, Sept. 22.

*Carbide of Calcium Plant at Meran.*—A long illustrated German abstract of the article, abstracted in the Digest May 27.—*Zeit. fuer Elektrochemie*, Sept. 21.

*Applications of Electro-Chemistry to Mechanical Engineering.*—COWPER-COLES.—The first part of an illustrated British Association paper giving a brief account of the processes of electro-galvanizing, copper and zinc deposition, and the manufacture of silvered parabolic mirrors.—Lond. *Elec. Rev.*, Sept. 22.

*The Variation of the Free Energy for Fused Halogene Combinations of Some Metals.*—CZEPINSKI.—An account of an experimental investigation of the polarization of cells with fused electrolytes at different temperatures, to test the theory of Gibbs and Helmholtz, based upon the second principle of thermodynamics.—*Zeit. Anorg. Chemie*, Vol. 19, p. 208; abstracted in *Zeit. fuer Elektrochemie*, Sept. 7.

LORENTZ.—Some theoretical remarks on the same subject, based upon the theory of ions.—*Zeit. Anorg. Chemie*, Vol. 19, p. 283; noticed in *Zeit. fuer Elektrochemie*, Sept. 7.

*Determination of the Degree of Saturation of Solutions.*—DAWSON and WILLIAMS.—An illustrated account of the experimental investigation, a preliminary account of which, given by Van't Hoff, was noticed in the Digest Sept. 2.—*Zeit. fuer Elektrochemie*, Aug. 31.

## UNITS, MEASUREMENTS AND INSTRUMENTS.

*Separation of the Core Losses in Alternating Current Transformers.*—PEUKERT.—After a brief outline of some other methods to separate the loss by hysteresis from that by eddy currents, he discusses at some length the method often used of calculating the loss by hysteresis from the formula of Steinmetz, and to obtain the eddy current loss by subtracting this calculated value from the whole loss. He claims that this method is not correct, as according to the formula of Steinmetz the loss by hysteresis per single period depends only upon the maximum induction and is independent of the frequency, which suppositions are not in agreement with many measurements. He made a series of measurements with eight frequencies between 24 and 55 and gives the results in the form of tables and two diagrams, one with volts as abscissas and watts as ordinates, giving eight curves for the eight frequencies, the other with the frequencies as abscissas and watts as ordinates, giving six curves for six values of the induction. His results show that the above named two suppositions of Steinmetz's formula are incorrect. To separate the loss by hysteresis from that by eddy currents, he calculates the eddy current loss by a formula of Feldmann, which he claims to be correct for a thickness of the iron plates up to 0.02 inch, and finds the hysteresis loss by subtraction.—*Elek. Zeit.*, Sept. 21.

*Silver Voltameter.*—KAHLE.—An account of a careful investigation made in the German Reichsanstalt, of the exactness of the silver voltameter. He found that two voltameters in series with identical platinum crucibles as cathodes, gave results differing less than one ten-thousandth, if both were treated in the same way. The method of washing has an effect as it was found that silver is dissolved to a considerable degree in hot water. With hot washing the precipitate was less by 0.28 milligram than with cold washing, the whole precipitate being about 1 gram; cold washing, however, is not sufficient for completely removing the nitrate of silver. The precipitate upon platinum was always found to be less than upon silver; the oftener a solution of nitrate of silver has been electrolyzed, the greater is the precipitate; an acid electrolyte which has frequently been used gives a larger precipitate than a fresh, neutral one. The difference of the precipitates upon platinum and upon silver was 0.19 milligram for a fresh electrolyte, 0.33 mg for an electrolyte which had been used several times, 0.91 mg for an acid electrolyte containing 1.4 mg of nitric acid for one gram of nitrate of silver. The legalized equivalent is 1.118 mg per second. The measurements with the silver voltameter were used for the determination of the e. m. f. of standard cells (see Digest Sept. 23).—*Wied. Ann.*, Vol. 67, p. 1; abstracted with much of the data, in the *Zeit. fuer Elektrochemie*, Aug. 3.

*Measuring Instruments.*—RAPS.—Two well illustrated papers read before the Electrotechnical Society of Berlin, one describing switchboard ammeters and voltmeters with air damping. The other is on a new alternating current wattmeter of Siemens & Halske, also with air damping, the principal idea being to have the movable coil surrounded by such a field of the fixed coil that the action of the latter field on it is independent of the position of the movable coil and depends only on the current flowing through it. If this coil is brought back into the zero position by a force proportional to the angle of deviation the deflections of the coil are proportional to the current. If the current in the fixed coil is proportional to the e. m. f., the instrument is a wattmeter and its deflections are proportional to the energy. The field in which the movable coil is located has a ring form, the lines of magnetic induction running in radial lines outwards across one-half and inwards across the other, in the same way as in the (incomplete) ring-shaped air gap of a bipolar dynamo. It is formed on one side of a circular wire ring, into which the current flows at one point, divides into two halves, and flows out at a diametrically opposite point.—*Elek. Zeit.*, Sept. 14.

*Caldwell Interrupter.*—SIMON.—An illustrated abstract of an article in which he gives an account of a continuation of his researches (see Digest July 15). There seems to be nothing new of importance.—*Elek. Zeit.*, Sept. 21.

REFERENCES.

*Measurement of the Distribution Resistance of Earth Plates.*—NOWOTNY.—An account of measurements, using the Wiechert method (see Digest Nov. 26, 1898). He could not find a dependency of the values of the resistance on the material of the auxiliary earth connection used in this method. The results are given in five tables.—*Zeit. fuer Elek.*, Aug. 20.

*Direct Determination of the Kilohm.*—GUILLET.—The conclusion of his long article (see Digest Sept. 30). In conclusion he gives the figures obtained in measuring the resistance of a coil of about a thousand ohms, from which the value of the ohm in metric units would be 106.214.—*L'Eclairage Elec.*, Sept. 9.

*Testing of Meters.*—SAHULKA.—The first parts of a long, illustrated description of the laboratory apparatus used in the testing rooms of the Standards Testing Committee in Vienna for testing meters in large quantities.—*Zeit. fuer Elek.*, Sept. 17, 24.

*Magunna Meter.*—An illustrated English translation of the article abstracted in the Digest Oct. 7. Editorially it is thought the idea is a promising one, and it remains only to be seen whether the test of time will fulfil the inventor's anticipations.—Lond. *Elec.*, Sept. 22.

*Measuring the Frequency.*—ZENNECK.—A French abstract of the article mentioned in the Digest Sept. 16.—*L'Eclairage Elec.*, Sept. 9.

*Loop Testing for Cable Faults.*—WRIGHT.—A reprint of the article noticed in the Digest Sept. 30.—*Elty*, Oct. 4.

*Caldwell Interrupter.*—SIMON.—A French abstract of the article mentioned in the Digest July 15.—*L'Eclairage Elec.*, Sept. 9.

## TELEGRAPHY, TELEPHONY AND SIGNALS.

*Railway Signals.*—BOULT.—The first part of a long, illustrated British Association paper on a system of magnetic railway signaling, specially suitable for fog signals. On the locomotive a pivoted needle is actuated by a condensing armature. On the road there are placed magnets so arranged as to establish a long magnetic field of transverse polarity, which deflect the needle on passing.—Lond. *Elec. Rev.*, Sept. 22.

REFERENCES.

*Switzerland.*—The first part of an article on official statistics concerning the telegraph and telephone service in Switzerland in 1898.—*Jour. Telegraphique*, Aug. 25.

*Telephone Statistics.*—Long tables of telephone statistics for the world for 1897.—*Jour. Telegraphique*, July 25.

*Independent Telephony in Michigan.*—WARE.—A reprint, with a map, of the article on the growth of the independent movement in

Michigan, from the *Michigan Tradesman.—El'ty,* Sept. 27, and *West. Elec.,* Sept. 30.

*Electric Alarm Clocks for Signals.*—An illustrated description of some forms of electric alarm clocks for signals on railways, in mines, etc., operated by a current of 0.5 amp. at 110 volts.—*Zeit. fuer Elek.,* Aug. 27.

## New Books.

RECHERCHE ELEMENTAIRE DES RELATIONS ENTRE LES GRANDEURS ELECTRICQUES DANS LES CIRCUITS PARCOURUS PAR DES COURANTS ALTERNATIFS. By Omer De Bast. Liege: Imprimerie de Léon de Thier. 88 pages, 47 diagrams.

This is an extract from the electrical course of the Liege Industrial School, published in Vol. X of the Bulletin of the Association of Electrical Engineers graduated from the Montefiore Electrotechnical Institute.

It is an elementary exposition of the fundamental laws and properties of alternating currents in single-phase and polyphase circuits. It is well adapted for an elementary electrotechnical course, studied from the theoretical point of view. Clock diagrams are abundantly used in the cuts. No vector notation or complex quantities are introduced. The cuts are the worst feature of the book, being very rough, and in some cases looking like free-hand sketches.

BOOKS RECEIVED.

THE RISE AND DEVELOPMENT OF THE LIQUEFACTION OF GASES. By Willett L. Hardin, Ph.D. New York: The Macmillan Company. 250 pages, 42 illustrations.

## Prospective Exhibits at the Chicago Street Railway Convention.

There is every prospect that the exhibits at the American Street Railway Convention next week will be large and comprehensive. We are advised of the following:

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY will make an extensive display and show a varied line of its apparatus. There will be exhibited one 500-kw E. T. railway generator; one standard railway switchboard for three generators, seven feeders and one load panel; one 200-kw rotary converter; one complete railway equipment, consisting of two No. 68 motors with controllers, diverters, fuse blocks, circuit breakers, etc., to be mounted on a Peckham truck; one complete equipment, consisting of two No. 49 35-hp railway motors with controllers, diverters, fuse blocks, circuit breakers, etc., to be mounted on a McGuire truck; one No. 68 motor complete; one No. 70 motor complete; one No. 69 motor complete; one No. 56 motor complete with pinion; one No. 56 armature complete; one No. 68 armature complete; one No. 69 armature complete; one No. 69 armature partially wound with commutator partially connected; two K-10 controllers with one set of handles; one street railway diverter taken apart; one canopy switch, style 5793; two canopy circuit breakers; two fuse boxes, 3794; one tank lightning arrester; one choke coil, style 2536; six 500-volt series arc lamps with switch for circuit, and three lightning arresters, style 6799.

THE IRONSIDES COMPANY, Columbus, Ohio, will exhibit among its specialties, materials for interior treatment of wire ropes and fibre ropes, in their manufacture, to provide lubrication and sealing properties; also other materials for the treatment of the same externally as protection against the influences of exposure and wear. Samples of both classes of ropes that have been treated by these materials, which are known as fillers and shields, respectively, will also be exhibited, besides cans of gear shields, and a model consisting of a pair of motor gears mounted on a suitable base. The gears will be treated with the gear shield. The company will also exhibit an assortment of sample strips of its belt shield, which is a dressing for leather belts; also an assortment of paints of different colors, especially adapted for extremely cold or hot and acid conditions. The application of these paints and their suitability for smokestacks, boiler fronts, roofing and structural work generally will be exemplified. The company will be represented by Mr. W. H. Bone, first vice-president and general manager; Mr. W. M. Watson, second vice-president, and R. T. Bone, sales agent for Illinois. A plentiful supply of literature will be available to the delegates and their friends.

WILLIAM WHARTON, JR., & COMPANY, INCORPORATED, Philadelphia, Pa., expects to make a display of its well-known manganese steel special work and its unbroken main line switch. As novelties the company will exhibit some frogs and mates for T-rail work solidly cast of manganese steel, and double spring rail frogs for suburban roads, which frogs are coming more and more into favor, not only where steam cars and street cars pass over the same track, but also on suburban street railways where the ballast does not go above the top of the ties, and therefore a spring frog is permissible. The Nichols' patent tongue switch with protected heel will also be shown; also two novel constructions of crossings of street railways over steam railways, in both of which manganese steel plays an important part. One of these styles is particularly adapted for paved city streets. The company will probably be represented at the convention by Mr. F. P. Howe, first vice-president; V. Angerer, second vice-president; Arthur A. Partridge, St. Louis representative, and J. C. Robinson, of the firm of Harrington, Robinson & Co., the Boston agents.

MESSRS. EUGENE MUNSELL & CO. and the Mica Insulator Company will make a combined exhibit at the street railway convention, having engaged a space of 200 square feet near the entrance. This exhibit will consist of "Mica" in its natural state and in its various forms for electrical insulation, also stamped "Mica" segments and washers, both India and amber. Very large specimens of "Mica" will be shown, which will be of interest to all electrical engineers and street railway managers. The exhibit of the Mica Insulator Company will consist largely of "Micanite" rings, segments, tubes, troughs, cloth, paper, etc., etc. The exhibit will be in charge of Mr. Charles E. Coleman, who has charge of the company's Western business. The company's Chicago offices are located at 117-119 Lake Street, where the electrical fraternity will be welcome during their short stay in Chicago.

THE OHIO BRASS COMPANY, Mansfield, Ohio, will make an exhibit which will cover 500 square feet of space located on the main aisle and near the main entrance of the exhibition hall. In a general way, the exhibit will consist of samples of this company's full line of trolley wire devices, feeder wire appliances, track bonding materials and motor and car supplies. The following named gentlemen from the head office will be in attendance: C. K. King, secretary; A. L. Wilkinson, salesman, and G. A. Mead, electrical engineer. The company hopes to make this exhibit the best that it has ever made at a street railway convention. It expects to distribute among its friends a souvenir which will be unusually attractive.

THE AMERICAN MASON SAFETY TREAD COMPANY, Boston, Mass., will show the application of the Mason safety tread to the steps of street cars. This tread is a combination of metals, non-slipping and practically unwearable. It is in use on the steps of over one thousand cars in various cities in this country, and the company states that it receives duplicate orders in almost every case where the steps are on trial. The street car work is but a minor feature of the company's business, however. The safety tread is more generally used on the steps of buildings. The interests of the company will be looked after by Mr. Herman Pfeffer, the Chicago agent.

THE EXHIBIT of the American Steel & Wire Company, New York and Chicago, will consist in the main of samples of all of the well-known products of the Washburn & Moen Manufacturing Company, including reels of bare and insulated cables for underground, submarine and aerial feeders; hard-drawn copper trolley wires of various shapes; power wires, span wire, car and trolley springs and "Crown" bonds, all of which will be arranged and displayed in an artistic manner. There will also be samples of Ellwood field fencing, which is now extensively used in fencing rights of way of interurban railway lines. The exhibit will be in charge of Mr. E. J. Pietzcker, of the Chicago office.

THE MANVILLE COVERING COMPANY, Chicago, proposes to make a complete and effective exhibit of the H. W. Johns Manufacturing Company's molded mica trolley line insulators, vulcabeston repair parts for motors, controllers, etc.; Johns electric heaters, asbestos pipe and boiler covering for power stations and asbestos roofing for car barns. The exhibit will be in charge of Mr. H. A. Reeves, manager of the electrical department. Messrs. T. F. Manville and T. G. Younglove will also be in attendance. It is expected that the

interests of the H. W. Johns Manufacturing Company will be looked after by six representatives of that concern.

THE TAYLOR ELECTRIC TRUCK COMPANY, Troy, N. Y., will show one of its extra heavy latest improved 8-foot wheel-base trucks; a set of its Empire State radial trucks and its latest design swing-motion double trucks. A new and special design of extra heavy swing-motion double truck for interurban service and suitable for very high speeds will also be exhibited. This truck is designed to meet the demand for high-speed service where electric railways are competing with steam railways. Mr. John Taylor will be in attendance at the convention, and will personally entertain all street railway men who visit the exhibit.

THE AMERICAN BRAKE SHOE COMPANY, Chicago, will make an exhibit of the Diamond "S" brake shoes. There will be present Messrs. J. W. Gardner, George H. Sargent and A. T. Herr, of the Sargent Company; H. H. Haskell, of the Ramapo Iron Works, Hillburn, N. Y. The exhibit will be in the direct charge of Mr. F. W. Sargent, of the American Brake Shoe Company. The Sargent Company and the Ramapo Iron Works manufacture Diamond "S" brake shoes under license from the American Brake Shoe Company.

THE H. W. JOHNS MANUFACTURING COMPANY, New York, will show a line of its molded mica overhead insulation and car heaters, together with its "Noark" indicating fuses. The exhibit will be in charge of the company's Western representatives, the Manville Covering Company, of Chicago. The company has secured 300 square feet of space in which to exhibit its goods. Fuses in actual service will be shown.

THE LESCHEN-MACOMBER-WHYTE COMPANY, Chicago, will have an extensive exhibit, consisting of galvanized steel strand, hard-drawn copper trolley wire, weatherproof feeder wires, magnet wire, rubber-insulated wire and cables, galvanized curtain cord, Beacon bearing metal and the line of street railway material manufactured by the Bibber-White Company, of Boston, for whom this firm acts as Western agent.

THE GRAHAM EQUIPMENT COMPANY, Boston, Mass., will exhibit one of its small 4-hp engines and boilers for motor vehicles. The company will also exhibit one of its heavy I-beam trucks for steam buses that are being built for the National Transportation Company, of Boston. These trucks are to be used in Winthrop, Brookline and Milton, where it is impossible for trolley railways to secure franchises.

THE CONTINUOUS RAIL JOINT COMPANY OF AMERICA, Newark, N. J., expects to have an exhibit of continuous rail joints and continuous step joints. The interests of the company will be looked after by Mr. H. M. Montgomery, of Chicago; Mr. W. F. Ellis, of Boston; Mr. F. C. Schmitz, of Newark; Mr. J. G. Miller, of St. Louis, and Mr. L. F. Braine, general manager of the company.

THE EXHIBIT of K. McLennan & Co., of Chicago, will consist of Gale's commutator compound. Mr. Martin J. Isaacs and Mr. J. B. Castle, of the company, will be in attendance and will endeavor to locate, if possible, any one who is not familiar with the merits of this compound. It is possible that a practical exhibition of the use of this compound will be made.

THE CONSOLIDATED CAR HEATING COMPANY, Albany, N. Y., expects to show a full line of its heating apparatus for the instruction of the delegates to the convention. The company will be represented by Mr. J. F. McElroy, Mr. F. W. Kelley, Mr. R. P. Scales, Mr. W. P. Cosper and Mr. J. N. DuBarry, Jr.

THE W. T. VAN DORN COMPANY, Chicago, expects to make a large exhibit which will include eleven patterns of couplings with all the different style of appliances for cars. A large space has been secured by the company and the exhibit will be in charge of Mr. W. T. Van Dorn, manager.

HEYWOOD BROTHERS & WAKEFIELD COMPANY, Chicago, will make a complete exhibit of street railway car seats in plush, rattan and moroccoline of the Wheeler, Bushnell and Henry makes. The company will be represented by Mr. James Hitchcock, Western agent.

THE MILLER-KNOBLOCK COMPANY, South Bend, Ind., will show a number of street railway assembled commutators, also machine-made armature coils. The exhibit will be in charge of Mr. A. W. Morrell, manager of the electrical department of the Miller-Knoblock Company.

THE SIEGRIST LUBRICATOR COMPANY, St. Louis, Mo., will show one of its latest improved automatic oiling tables, automatic oil cups and lubricators. Mr. J. N. Edelin, general manager of the company, will be in attendance at the convention.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., will have a display of Dixon's graphited wood grease, Dixon's graphite lubricant and other graphite goods used by railway companies.

The Q. & C. COMPANY, Chicago, will have a joint exhibit with the Pennsylvania Steel Company, for which it is Western agent.

## The Affairs of the Phoenix Battery Manufacturing Co.

Sometime ago, it appears, the National Carbon Company bought the plant of the Phœnix Battery Manufacturing Company, of St. Louis, for $187,000, the latter concern reserving patents and patterns on some specialties while a clause in the bill of sale required six months' notice when possession was desired. A week or two ago possession was demanded by a representative of the National Carbon Company, and being denied, the plant was seized on a writ of replevin. To lift this writ, the Phœnix Company has given a bond in the sum of $40,000 which the United States Marshal has accepted, releasing the plant. The bond is executed by the St. Louis Trust Company and the Phœnix officials.

Discussing the matter, and the facts as set forth above, Colonel Booker, of the Phœnix Company, says: "The proposition, from our standpoint, is a simple one. We do not deny that the local plant has been purchased from us by the trust. It has paid the purchase price, and we have received it. However, there is a clause in the contract which provides that written notice shall be given and that a period of six months shall elapse after that notice before possession has to be given. We have received no such notice. To give possession at once and allow this foreign corporation to come in here and close out the business would ruin my chances of continuing in the same line of business in a new plant at Oak Hill, where I have buildings in process of construction. The financial institutions which are backing me are determined that local business integrity shall not be attacked in this manner. We have been trying faithfully to effect a compromise with the National Carbon Company ever since they took such precipitous action, and have not been able to get a satisfactory concession in the matter."

## The Chicago & Milwaukee Railway System of Generation and Distribution.

The recent completion of the 27 mile line of the Chicago & Milwaukee Electric Railway, by the successful opening of the 12 mile double track extension, has attracted attention to this latest addition to Chicago's suburban electric service. Its equipment, which includes the use of rotary converters and three storage battery auxiliaries, represents several steps in advance of ordinary high speed interurban railway practice, and the train of circumstances which led to the use of this system is worthy of note.

Four years ago, while acting in the capacity of consulting electrical engineer for a long distance high speed electric line, Mr. Bion J. Arnold, of Chicago, worked out as a solution of the problem of electrical generation and distribution for such service, the following system:

The road was to be divided into sections and at about the middle of each section, except that one contiguous to the power house, was to be located a substation containing a storage battery and an equipment of rotary transformers and converters. These transformers and converters were to receive their energy over a three-phase transmission line extending back to the high-tension alternating current generators in the main power house. This power house was also to contain direct-current machinery sufficient to supply the section of road adjacent to it.

This arrangement presented so many advantages over the ordinary direct-current distribution system that when Mr. Arnold was called in as consulting engineer for the Chicago & Milwaukee Electric Railway, it was the system which he advised, and the first section of the road extending from Waukegan to Highland Park was built by C. E. Loss & Company, after this plan, with a substation at North Chicago, containing only one rotary converter without a storage battery, and a power house at Highwood containing one 5500-volt three-phase alternator.

The extension and completion of the line brought about a change of management, and developed some opposition to the alternate

current system. Mr. Arnold was so thoroughly convinced, however, that this system possessed advantages both as to first cost and economy of operation, that the Arnold Electric Power Station Company, of which he is president, submitted to the officers of the company a proposition to complete the equipment of the road along the original lines, and guaranteed the system to work with a certain specified efficiency. Under these conditions the contract for the extension, with the exception of the rolling stock and track, was awarded to the Arnold Company. This contract included the engine, direct-current and alternating-current generators, switchboards, transformers, rotary convertors, economizer, pumps, mechanical draft, condensers, piping, cooling table and reservoir, power house building, battery room, car barn, offices, two substations, overhead equipment and transmission line erected complete ready for operation. The contract for this equipment would have been notable in itself, but the economy clause gives to it an added interest.

The policy adopted by the Arnold Electric Power Station Company, of working out its own solution of an engineering problem, of submitting plans and specifications with its proposition, together with an economy guarantee covering the entire installation, is one that has much merit. Another feature of the Arnold Company's methods, is that it is in no way connected with any manufacturing company, which leaves it free to purchase machinery and apparatus of any make upon the open market.

## Electrical Power Distribution in a Rubber Factory.

The B. F. Goodrich Company, of Akron, Ohio, the well-known rubber manufacturers, are introducing an electrical power plant to take the place of their present steam drive. In the New England States, where fuel is expensive, electricity is largely applied to manufacturing industries, but to find in the heart of the coal regions electricity substituted for steam, is somewhat of a novelty, and shows that the electrical system has other features to recommend it beyond the fact of its economy in fuel consumption.

The Goodrich Company has been operating a factory which has grown from time to time, the power for the additions having been secured from steam engines placed where the power was required, and the supply of steam has been mainly from a large battery of boilers, supplemented by other boilers situated in different places. This has been an evolution which has come about from the small additions occurring from time to time. An extension is about to be made to the factory, covering a considerable additional area. This has necessitated an additional steam plant. The problem arose whether to add to the boiler plant, or to consolidate all the steam generating apparatus into one central power house, and then distribute the power to the factory electrically. It was found that the latter method was the most economical and has been adopted.

Current for the lighting of the factory has been supplied from dynamos of small sizes, placed at different points. Some eight or ten different machines of small sizes and various makes have been employed. These will be discarded and the lighting and power all taken from a common system.

The Westinghouse Electric & Manufacturing Company will supply the entire electrical equipment, which is being installed under the direction of Mr. E. C. Shaw, electrical engineer to the Goodrich Company, with whom many of the ideas embodied in the plant are original. The electrical apparatus is already well advanced, and the early spring should see the plant in operation.

The engine and boiler houses will be of steel construction; the former 130 by 80 feet, with coal bunkers overhead having a capacity of 800 tons. The boilers will aggregate 3000-hp, and be equipped with mechanical stokers and coal conveyors, to secure economy in labor and fuel consumption, and also smokeless combustion.

The engine room will measure 124 by 50 feet, and contain three compound condensing high speed Corliss type engines, direct-connected to three Westinghouse two-phase generators; two of which will be of 500-kw, and one 150-kw. The three generators will be arranged to work in multiple. This central power station will supply the electric lighting system throughout the buildings, and furnish power to about 60 Westinghouse type "C" induction motors scattered over the departments of the works. A very elaborate switchboard has been built by the Westinghouse Company, to provide for the multiple running of the generators, and to control the circuits of lighting and power. Each power circuit will be furnished with a two-phase Westinghouse integrating wattmeter to register the exact amount of power used by each department of the works. The engineer in charge will be able to read the total amount of power supplied.

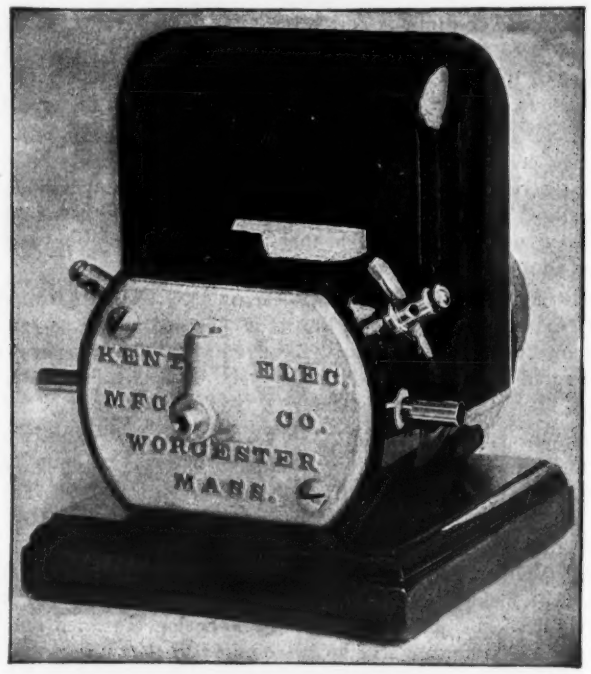
About 60 motors will be installed, varying from 300-hp to 1-hp, with an aggregate capacity of 2000-hp. Some of these will be attached directly to individual machines such as tube mills, calender rolls, elevators, etc., each machine having its separate motor. The lighter machines will be connected by belts to shafting, and a single motor will drive a group of them. The type of motor used affords great advantages for factory work, as it is virtually automatic, requiring nothing but an oil supply once in three months; an unskilled attendant can operate them, and having no commutator or brushes, there is no sparking, or danger from fire, even when working among inflammable or explosive materials. The motors can be bolted to beams, or stood upon a platform, or placed in any position where they occupy no valuable space.

The primary object in this departure by the Goodrich Company, is to secure the economy in operation which an electrical drive affords. Sixteen separate steam engines will be supplanted, and the power plant concentrated under one roof. In an immense factory like that of the Goodrich Company it is very costly to operate separate steam engines, as the loss by condensation and leakage of steam pipes is a serious item. Under the new system, electricity will be carried by feed wires to all parts of the works and converted into mechanical power by electric motors. Experience in many industries has shown that the electrical drive economizes three-fourths of the power that was required for operating separate steam engines. Another signal advantage of electrical operation is its flexibility as to extensions, which can be effected by simply adding further generating units and the necessary additional wire feeders.

## Dynamo for Gas Engine Ignition.

The accompanying illustration shows one of two types of small generators made by the Kent Electric Manufacturing Company of Worcester, Mass., for the electric ignition of gas engines, which, we are informed, have been satisfactorily used for some months on a number of engines.

One is an enclosed waterproof type for marine work and the other is an open type for stationary engines. The field magnets are compound wound and can be relied upon to give the same




DYNAMO FOR GAS ENGINE IGNITION.

voltage at a certain speed. The coils are painted with waterproof varnish and protected by a covering. Both are solid machines and built for continued, long runs. The shafts are turned from the best of steel and the bearings are made from a very hard chemical bronze. The self-feeding woven wire brushes are prepared for self-lubrication and wear the commutator to a polished surface.

## Fire Engine Search-Light Plant.

The New York Fire Department has lately placed an order with the La France Fire Engine Company of Elmira, N. Y., a complete fire engine searchlight plant, consisting of a standard New York fire engine which in place of the pumping machinery will be equipped with a Bullock Multipolar dynamo direct connected to a high speed Forbes engine. On a platform just behind the driver there will be mounted two 18-inch Rushmore marine projectors, to be supplied by the Rushmore Dynamo Works of Jersey City, N. J. Each projector will be fitted with a special diverging lens with which the beam of light may be spread out to cover as wide an area as desired so it will be equally effective at long or short range. The projectors may be quickly removed from the engine and set upon the ground at any distance from the engine to which it is connected by a flexible cable carried upon a reel under the driver's seat.

This engine will answer alarms with the other apparatus and by instantly lighting up the scene of a fire will greatly reduce the delay and dangers of fighting fires in the congested business district.

## United States Army Electric Wagons.

A contract has been executed by the Woods Motor Vehicle Company, of New York and Chicago, Ill., for three automobiles for the Signal Corps of the United States Army, expressly under the specifications of the Chief Signal Officer. Two wagons are made like Fig. 1 and are designed to carry the Signal Corps' various instruments and paraphernalia, and one wagon like Fig. 2 designed for the officers of the Signal Corps to ride in.

FIG. 2.—WAGON FOR SIGNAL OFFICERS.

The equipment of the first mentioned wagons consists of 40 cells of storage batery of sufficient capacity to run these vehicles 30 miles on one charge of the batteries carrying 1500 pounds transportation load. The motor equipment consists of two 3½-hp motors, one attached directly and independently to either rear wheel and are so wound and designed that they can be worked on grades and bad roads to as high as 6-hp each, which would mean a maximum horse-power capacity of 12-hp for each wagon, with batteries of sufficient size to work at that point for temporary work.

FIG. 1.—WAGON FOR SIGNAL APPARATUS.

The maximum speed of the vehicles is 10 miles per hour. A novel feature of these vehicles is the entire absence of anything like bicycle construction or ordinary carriage gear. Every piece of iron work in the vehicle from start to finish was hand-forged in the smith shops of the Woods Company. The wheels were especially designed and made for this company with steel hubs, the inside of which forms receptacles for the ball-bearings, as it was found that iron hubs were not adequate to this work. In lieu of anything like pneumatic tires, solid hard rubber tires 2½ inches in diameter have been used, as the army cannot afford to take any chances of punctured tires or breakdowns from any such cause.

While similar in exterior appearance to delivery wagons, the interior arrangement of these automobiles is constructed after special army specifications and is accessible from both rear and front, and are supplied with doors, which, when the wagons are not in use, lock everything securely on the interior. Another very noticeable feature of these vehicles is their painting, as they are finished in olive green in both body and gear without any ornament or striping, being painted as near the color of grass and foliage as possible so as not to be conspicuous to the enemy in the field. They are fitted up with electric lights in the side lanterns, and in the larger vehicles in the interior also, and it is understood that later, a new form of searchlight will be added to the equipment of these wagons for use as occasion may require.

*ELECTRIC TRACTION ON THE ERIE CANAL.*—It is stated that the executive committee of the Erie Canal Electric Traction Company has adopted the storage battery system for use as its motive power, subject to the approval of the Superintendent of Public Works.

# NEWS OF THE WEEK.

## Financial Intelligence.

THE WEEK IN WALL STREET.—There are many reasons why stocks should be strong, and but few reasons why they should be weak. This probably accounts for the steadiness and general firmness of the market, in spite of the high rates for money that have been prevalent the past month. However, the period of monetary outflow is about closing, and there seems little cause for apprehension in the future as to dear money. During the week 4042 shares of Western Union were sold, closing at 87⅜. Of Brooklyn Rapid Transit 257,692 shares exchanged hands, closing at 88¼, and Metropolitan Street Railway, on transactions in 15,236 shares, closed at 197¼. General Electric was very dull, and on sales of only 2845 shares closed at 118. In Boston, American Bell Telephone made a splendid rise of 19 points to 383, and Boston Elevated closed at 107. Copper stocks were strong. In Philadelphia, Electric Storage Battery common was 126 to 130, and preferred 129 to 135; Philadelphia Traction, 95¾; Union Traction, 38⅞ to 39⅛; Pennsylvania Manufacturing Company, 283⅜; National Electric, 10¾; Brooklyn Gas & Electric, 13¼. Outside securities in New York were dull and steady. Electric Axle Light & Power was quoted 5½ to 6⅛; Electric Boat common, 18 to 20, preferred, 42; Electric Vehicle common, 85 to 90, preferred, 100 to 110; N. Y. Electric Vehicle Transportation, 18 to 18¾; New England Vehicle, 8⅞ to 9⅛; Illinois Vehicle, 4 to 4½; Otis Elevator, 33 to 34½ common, and 93 to 96 preferred; Hudson River Telephone, 110 to 115.

THE FORD FRANCHISE LAW, which is about to be enforced in New York State, and which is a matter of deep interest in other States, embodies practically the following questions which every corporation is required to answer under oath: Title of company; full name of all the officers; full description of special franchise, showing streets, highways or public places possessed or rights enjoyed; copy of grant under which franchise is held and full statement of any obligation imposed on the franchise; cost of real estate and improvements; cost of equipment; stocks and bonds of other companies held; award of materials and supplies on hand; total of accounts and bills receivable; cash on hand; capital stock; funded debt; accounts and bills payable; interest on funded debt; rentals due and accrued; dividends unpaid; amount of common and preferred stock issued; highest and lowest and market value of the stock within a year; receipts from operations, from interest and dividends, from rentals, from sales of stocks and bonds, from other sources and temporary loans; salaries of general officers, clerks and general expenses; disbursements of all kinds for maintenance and construction for rentals, interest, taxes, etc.; cost of tangible real property; value of tangible real property, based on cost of reproduction; cost of real property not included in the special franchise; value of real property not included in special franchise based on cost of reproduction; assessed value of real property included in franchise; assessed val e of real property not included in franchise; mileage of tracks, sideings, wires, cables or other conductors, in, upon, under or over streets or highways in each tax district.

SPRINGFIELD RAILWAY PROPERTIES.—One effect of prosperous times is the rehabilitation of bankrupt properties. One of these was the Springfield Consolidated Street Railway, of Springfield, Ill., the original lines having been bought and consolidated by Louisville capitalists, who relied upon the introduction of electric power to give them a profit. They overcapitalized the road by issuing $750,000 of stock and $418,000 of 5 per cent. bonds, in addition to $100,000 of 8 per cent., payable 1911, and $125,000 of 6 per cent., due 1910, which were taken over with the old lines. The road was electrified in 1896 and 1897, but its earnings were not equal to the fixed charges. Interest was paid for the last time in June, 1897. The December coupons were canceled and the bondholders agreed to accept 3 per cent. for 1898 and 1899, and 4 per cent. for 1900 and 1901. There was also a floating debt of about $90,000. This has now been reduced to $45,000, and earnings have so greatly increased that the road in eight months of this year has earned fixed charges and operating expenses and 3 per cent. on the stock. The gross last year was $121,432, net $47,101, and this year over $140,000 gross will be earned. In consequence insiders have been buying all the stock, and from a nominal quotation of 5 it is in active request at 13. The bonds which sold at 50 last year are now 75 and scarcely to be had.

B. R. T. IMPROVEMENT.—The statement of the Brooklyn Rapid Transit system for September showed a moderate gain in earnings over the previous year. The statement for three months showed gross earnings of $2,860,777, compared with $2,832,817 for the corresponding time last year. Gross earnings for the three months of $2,860,777 would give, with operating expenses at 60 per cent., net earnings of $1,144,310. Fixed charges of the system call for an average for the quarter of $575,000, deducting which would leave available for dividends $569,310. This sum on $43,000,000 of stock would be about 1.3 per cent. It is proper to say that the September quarter is distinctly the best quarter of the year.

MASSACHUSETTS ELECTRIC COMPANIES.—The street railway companies comprising the Massachusetts Electric Companies show gross earnings for the fiscal year ending Sept. 30, 1898, and Sept. 30, 1899, as follows:

| | 1899. | 1898. | Inc. |
|---|---|---|---|
| Gross | $4,479,122 | $4,111,132 | $367,990 |

Five of the companies included in the foregoing in 1899 were not operated during the whole two years. Comparison of the companies operated during both years is as follows:

| | 1899. | 1898. | Inc. |
|---|---|---|---|
| Gross | $4,322,272 | $4,028,060 | $294,211 |

The accounts are not yet completed so as to show the net earnings, but from tne completed figures of 11 months of operation, enough may be learned to show a very substantial increase in the net income.

THE COLUMBUS CONSOLIDATION.—The three street railway lines of Columbus, Ohio, the Columbus, the Columbus Central, and the Cross Town, have been consolidated under one management, with Robert E. Sheldon as president and P. V. Burrington as secretary. E. K. Stewart, general manager of the Columbus, will be made general manager of the consolidation. W. S. Rowe, cashier of the First National Bank of Cincinnati, recently bought the Central for $1,300,000. The officers of the consolidation executed a mortgage for $7,000,000 in favor of the Union Savings Bank & Trust Company of Cincinnati. The Columbus, into which the other two lines were practically merged, is a wealthy and prosperous corporation and was the first on the ground.

## Commercial Intelligence.

THE WEEK IN TRADE.—Business for the last quarter of the year opens well. In the electrical field it could hardly be better. The demand for electrical apparatus of American make at home and abroad has never been as great as now, and all the productive capacity of the country is taxed to meet the demand. In some electrical lines prices might be higher and more in consonance with others, but they are better than they were. Electrical shops are running everywhere on full time, and extra time, but there is a wise tendency not to expand facilities to the utmost and then suffer doubly bad consequences later. General trade and industrial conditions are excellent everywhere. The record of business failures for the third quarter of the year is the best in a long time, and shows a decline of 20 per cent. from 1898. Bank clearings for the nine months were $691,063,450,281, or more than the whole year of 1898. As to railroads, reports from 57 roads for the month of September show total gross earnings to be $37,032,314, a gain of 12.1 per cent. over September a year ago. For the fourth week of September, 38 roads report gross earnings of $9,202,000, a gain over last year of 20 per cent. Gross receipts of 51 roads for August show a gain over 1898 of 18.7 per cent., while net receipts show an increase of 21.7 per cent.

HEAVY WORK IN NEW YORK.—Whatever else may be doing in other parts of the country, it is certain that New York City offers some of the finest contracts to be awarded in the near future. Not only is there the equipment for the colossal new station of the New York Gas & Electric Light, Heat and Power Company, but there are looming up close at hand the orders for the Manhattan Elevated and the proposed Rapid Transit Underground—both electrical. The Manhattan officials have lately been making trips to Schenectady and Pittsburg, and soon the orders will be placed. Back of that lies the contract for the underground. The whole work means the expenditure of some $35,000,000 at least. Every verbal safeguard is inserted in the official contract to insure the city against inferior work of any kind. All materials of the construction must be approved by the Rapid Transit Board's engineer, and after the road is entirely completed, every part of it must be approved by the board before the last of the contracted dues will be paid. The contract aims to cover every specification of the work possible of anticipation, but to cover any omission this clause is inserted: "The contractor understands, and it is expressly agreed, that there is included within its obligation the complete construction and equipment of the railroad as herein contemplated. The railroad is to be constructed for actual use and

operation as an intra urban railroad of the highest class, adapted to the necessities of the people of the City of New York. The contractor shall construct, complete and fully equip the railroad in the best manner, according to the best rules and usages of railroad construction, so that the railroad shall be thoroughly fitted for safe, continuous, immediate and full operation." It will probably be a year or two before the tunnel system is ready to receive its electrical equipment, but the city is getting ready to raise the $25,000,000 with which to build the road.

WORK ON THE BOSTON ELEVATED is being pushed. The management is hoping to complete it before the close of next year. As to the progress that has been made: The piers which support the columns are all in except for a distance of about three-quarters of a mile on Atlantic avenue and Commercial street. The elevated structure has been completed across Charlestown bridge, across City Square, Charlestown, and as far as Dover street on Washington street. Buildings have been razed at Dudley street and also at Sullivan Square, Charlestown, where the two terminals will be constructed. Contracts have been placed for two 4500-hp engines and generators to correspond, also boilers for the new power house at Lincoln's Wharf. The Providence Engineering Company secured the contract for the engines, Babcock & Wilcox for the boilers, and contracts for the two generators were divided between the General Electric and Westinghouse companies. Officials of the elevated company have seen experimental trains operated by the multiple unit system, but no contracts have been placed for rolling stock as yet. The whole matter of equipment is being thoroughly investigated. The company is working gangs of men nights putting up the structure, and to date the work has progressed according to schedule.

EXPORTS OF ELECTRICAL MATERIALS FROM NEW YORK.—The following exports of electrical materials were made from the port of New York for the week ending Oct. 7: British Guiana, 1 case electrical materials $10. Brazil, 6 packages electrical materials $1627. British West Indies, 14 packages electrical materials $20. British East Indies, 45 packages electrical materials $1511; 8 cases electric machines $2075. British Possessions in Africa, 51 packages electrical materials $3287; 4 packages electrical materials $1210. Cuba, 2 packages electrical materials $72. Central America, 363 packages electrical materials $1035. Genoa, 12 packages electrical materials $547. Havre, 94 packages electrical materials $16,503. Hamburg, 78 cases electrical materials $3812; 58 packages electrical materials $2875. London, 36 cases electrical carriages $1115. Mexico, 2 cases electrical materials $25. Milan, 4 packages electrical materials $69. Marseilles, 418 packages of electrical materials $50,620. Newcastle, 15 packages electrical materials $475. Newfoundland, 3 cases electrical materials $60. Venice, 2 packages electrical materials $85.

DECLINE IN COPPER.—The larger use made of electrolytic copper has been one of the grounds for the belief, urged in these columns, that copper could not maintain very long its present high range of price. This fact is becoming generally recognized, and the following from the *Iron Age* sums up the situation at this moment: "One phase of the situation in copper is giving thoughtful men in the industry considerable concern. For some time past there has been a difference which is close to one cent per pound between the prices of lake and electrolytic brands. The fear is expressed—and there is some justification for it—that this difference in the price will induce an increasing number of consumers to experiment with electrolytic copper with the result that they will learn to handle it effectively. In other words, many of those whom conservatism has still kept firm in the ranks of consumers of lake copper exclusively will waver in the faith, and when the present pressure for supplies has passed the spread between lake and electrolytic copper will be permanently carried down to a much lower figure than it has ever been."

STORAGE BATTERY EQUIPMENTS.—A building is to be erected on Fifth and Lombard Streets, Philadelphia, as a storage battery station of the Union Traction Company. The structure will be of brick and terra cotta, two stories high, and will be the largest of the four similar plants about to be established by the company in widely separated parts of the city—on Germantown Avenue, near Erie avenue; Thirty-second and Dauphin Streets, and Ninth Street, above Dauphin. The plans for the one at Fifth and Lombard streets have been submitted for approval, and it is probable that in a few days the demolition of the old buildings will be begun and work on the storage plant be started. It will contain a battery of 250 large cells, the total capacity of which will be equivalent to 250-hp. The Germantown Avenue plant will be nearly as large, and the other two of about three-fifths the capacity. For several years a small storage plant has been in operation at Chestnut Hill, and has been valuable in equalizing power on the Germantown and Chestnut Hill line. It is probable that after the proposed new plants are installed others will be planned for Kensington, Frankford and West Philadelphia.

THE LONG & ALLSTATTER COMPANY, Hamilton, Ohio, has been doing a remarkably good export business, every week bringing in its share of orders from abroad. It is at present making shipments to Russia, Germany, France, Japan and Scotland. The export business has not been allowed to interfere with the domestic business, but in order to meet the extraordinary demand put upon it, the company has had to enlarge its foundry, which now covers 46x206 feet. It has also put in two 30-ton cranes and a number of new machine tools. The company has orders on hand which will keep it busy for some time to come, but is making every effort to fill all orders as promptly as possible under the circumstances. In its own state, at Lorain, it has erected two large billet shears for the Johnston Steel Works. These shears each weigh 200,000 pounds, which gives some idea of the size of the tools the Long & Allstatter Company has the facilities for building.

BONNER RAIL WAGONS.—Col. J. C. Bonner, whose ingenious system of combining road freight wagons and rail haulage on electric systems has been frequently noted in these pages, has just returned home from England, where his devices have attracted a great deal of attention. On the Isle of Man Tramways & Electric Power Company, the Bonner wagons have already been adopted and applied to the haulage of granite. Col. Bonner now has orders from them for three equipments to start with and ten in all, five wagons to carry three tons each and five to carry five tons. Several of the new light railways for England have incorporated the Bonner wagons into their scheme, and it is likely that a company may be formed there to manufacture on the ground. Col. Bonner has returned to negotiate for wagons with some street railway companies in this country.

THE MANHATTAN GENERAL CONSTRUCTION COMPANY, of Newark, manufacturers of the "Manhattan" arc lamp, are meeting with marked success in the introduction of the Manhattan series alternating current enclosed arc system, and among some of the contracts which they have closed they mention orders for 850 lamps and 9 regulators for the San Gabriel Electric Company, Los Angeles, Cal.; 1 regulator and 25 lamps, for the People's Gas & Electric Company, Peoria, Ill.; 1 regulator and 35 lamps, for the Electric Light Company, of Hot Springs, Ark.; 3 regulators and 117 lamps, for the Middlesex and Monmouth Electric Company, of Matteawan, South Amboy and Keyport, N. J. The company are operating their factory at Newark night and day in an endeavor to catch up with the orders at present on their books.

FOREIGN TRADE IN AUGUST.—The returns for August of foreign trade show that electrical apparatus is holding its own very well The export of electrical machinery for the month was $230,009, as compared with $143,151 in 1898. The total for the eight months of this year is $1,828,048, as compared with $1,439,743. Of stationary steam engines for the eight months there were 547, valued at $304,107 in the eight months, as compared with 358, valued at $258,274, in the same period of 1898. Parts of engines and boilers for the eight months total at $907,136, as compared with $749,063. The export of instruments, including electrical, was $470,461 for August, against $341,593 in 1898, and for the eight months the total was $3,610,966, as compared with $1,987,653 in the same period of last year.

PELTON WHEELS IN EUROPE.—One of the fall homecomers from Europe is President A. P. Brayton, of the Pelton Water Wheel Company, of San Francisco and New York. He has been making an extensive trip through Europe, and has found very favorable conditions almost everywhere for the use of his wheels. They are now to be found in Sweden and Norway, in France, Italy and Switzerland, and in fact in all places where there is head sufficient to enable the Pelton type to show its great efficiency in power conversion for electrical purposes. Mr. Brayton states that their business from Mexico and South America is also excellent.

POWER FROM THE CHATTAHOOCHEE.—The Columbus Power Company now have their plant in course of construction on the Chattahoochee River, and hope to have it completed by next February. Contracts for the hydraulic machinery have been let to the Holyoke Machine Company, of Worcester, Mass., and for the electrical apparatus to the Stanley Electric Manufacturing Company, of Pittsfield, Mass. The plant is to develop 8000-hp. Mr. W. C. Whitner is the chief engineer of the company, with headquarters at Columbus, Ga. Mr. H. M. Comer, of Savannah, Ga., is the president of the enterprise.

THE CREFELD ELECTRICAL WORKS, of Saylesville, R. I., have been bought by the American Electrical Works. Mr. Phillips has removed their plant to a substantial new three-story brick building, 130 feet by 60 feet, adjoining the American Electrical Works' factories, at Phillipsdale, R. I.

THE SCHMIDT & BRUCKNER ELECTRIC COMPANY, New York City, have been awarded the contract to equip the independent telephone exchange, at Syracuse, N. Y., with 3000 telephones, with automatic call and centralized battery system and Fowler luminous drop.

# Special Correspondence.

## NEW YORK NOTES.

New York, Oct. 10, 1899.

THIRD RAIL.—President Rossiter, of Brooklyn Rapid Transit, announces that the Kings County Elevated and Brighton Beach lines will be operated by the third rail electric system from the Manhattan end of the Bridge to Brighton Beach within a few days.

MR. JOHN C. LOTT is now representing the Fort Wayne Electric Works in this city, with headquarters at 93 Liberty Street. He is a practical engineer and supervised the installations of the old Fort Wayne Corporation in the East. He will be glad to meet patrons of the system at his office and to answer promptly all inquiries for information.

RAPID TRANSIT.—Corporation Counsel Whalen expects that within a week bids for construction of the underground rapid transit road might be called for. The new form of contract provides for building of the line in sections and eliminates the absolute provision for additional rental of a sum equal to 5 per cent. upon the excess of gross receipts above $5,000,000.

CHICAGO STREET RAILWAY CONVENTION.—The special train for the annual meeting of the American Street Railway Association at Chicago on Oct. 17, leaves Grand Central at 1 p. m. on Sunday, Oct. 15, and the Boston section leaves that city at 10:30 a. m. the same day. The united train will leave Albany at 4:35 and Buffalo at midnight, reaching Chicago at 2:30 on Monday. The train will consist of Wagner vestibuled drawing-room sleepers and a dining car. The special rate of one and one-third fare on the certificate plan has been made. A large party is expected.

NEW YORK CENTRAL'S AUTOMOBILES.—It is stated that the New York Central & Hudson River Railroad Company will replace its present cabs with the latest improved automobiles just as soon as the new vehicles can be manufactured. The Lake Shore road, too, will discard its cabs in Chicago. It has placed orders for the new vehicles with the new $10,000,000 Woods Motor Vehicle Company, recently incorporated in New Jersey. Vice-President J. Wesley Allison, of the Woods Company, says he also has orders from Manager Boldt, of the Waldorf-Astoria Hotel, for automobiles for his hotel service.

ROSSITER, MacGOVERN & CO. have purchased the entire plant of the Excelsior Electric Company, of Brooklyn, N. Y., together with all tools and machinery. This is one of the best and most completely equipped electrical factories in this section of the country, and it is an important and valuable addition to the firm's present facilities. One branch of the factory will be given over entirely to repair work. The fact that they employ constantly, on their own work, a large force of experienced mechanics, enables them to render most prompt and efficient service in this connection. They give special attention to rewinding railway armatures. Their stock of electrical apparatus will be greatly enlarged owing to the increased capacity of the new works, and includes all the modern types and best known makes.

NO PAY, NO LIGHT.—True to its threat, the Staten Island Electric Company shut off the current from all the street lights in Richmond Borough on the night of Oct. 1. The streets were in darkness, and are likely to remain so until some arrangement is reached between the city and the electric company. The company a few weeks ago sent the formal notice of its intention to Commissioner Kearny, but nothing was done by the city. The city now owes the company, according to the company's accounting, about $175,000. Not a cent has been paid to the company since Staten Island became Richmond Borough. Controller Coler has refused to approve all the bills presented by the company, whether for lights furnished before or since consolidation. Flaws in the contracts entered into between the old governing boards of the towns and villages of Richmond County and the electric company are given as the cause for nonpayment of the bills.

Niagara Falls, Oct. 7, 1899.

TELEPHONE CABLE CONDUITS IN NIAGARA FALLS.—The Bell Telephone Company is about to build three cable conduits, on Falls, Third and Ferry Streets, Niagara Falls.

NEW WHEEL PIT BIDS.—The bids for the work of constructing the new wheel pit of the Niagara Falls Power Company were opened at noon Oct. 5 in the company's office at Niagara Falls, but the award was not at that time announced.

THE NIAGARA FALLS POWER COMPANY has notified the common council of Niagara Falls that it will construct a conduit instead of a pole line for transmitting current to Canada. This conduit will be of considerable length, and will be built at once.

THE NIAGARA FALLS HYDRAULIC POWER & MANUFACTURING COMPANY is about to complete the wheel capacity of its large and latest penstock by installing two additional wheels and four generators. It is understood that R. D. Wood & Co. will make the turbines and the General Electric Company the generators. When these new turbines are in place all of the five valves of the big penstock will be in service.

THE STANDARD ACID COMPANY is the name of a new concern that will do business in North Tonawanda. The capital stock is $100,000. The incorporators and directors are W. E. Crume, of Dayton, O.; Robert McLean, of Buffalo; Arthur Stem, of Cincinnati, and Frederick Chormann, of Niagara Falls. It is understood that the Carter-Crume Company is back of the new company. It is stated that it will be quite a large industry and that electric power will be used.

PROPOSED ELECTRIC RAILWAY IN CANADA.—On Wednesday, Oct. 4, interested parties, headed by William M. German, M. P., appeared before Hon. A. S. Hardy, provincial premier in Toronto, Can., and asked for an order-in-council granting permission to build an electric road from Chippawa to Welland, Ont. The men interested are mainly from Niagara Falls, Ont., and Fort Erie, Ont. The company contemplates doing a passenger and a freight business. Connections will be made both at Chippawa and Welland with boat. The government took the matter under consideration.

THE INTERNATIONAL TRACTION COMPANY has been giving the employees of its various branches an outing during the summer, and on Oct. 6 the employees of the Niagara Falls line were given an outing in Buffalo. In the evening they were sent to the theatre and had a delightful time. The company has filed plans with the bureau of buildings in Buffalo for a new car house, which it will erect at the corner of Jefferson and Eagle Streets. A transformer station will also be located at that point. The commissioners of the land office of the state have approved the agreement made by the International Traction Company and the commissioners of the state reservation for laying a track along Riverway on the Niagara state reservation, and the road will be built this fall, it is understood.

THE ACHESON GRAPHITE CO., of Niagara Falls, has made a contract with an European firm, under the terms of which it will graphitize ninety-six tons of carbon rods. The rods are to be furnished by the National Carbon Company, and will be graphitized in the furnaces of the Carborundum Company pending the completion of the furnaces and plant of the Acheson Graphite Company. The job will consume about four months. This is believed to be the largest single order in this line ever recorded. Europe has never imported carbon rods from the United States, but the discovery of Mr. E. G. Acheson has made it possible for Niagara Falls to lead the world in this line of furnace output. There is no firm in Europe that could fill such a contract. Mr. Acheson is receiving the congratulations of all the manufacturers at Niagara Falls for the wonderful success of his inventions.

## PENNSYLVANIA AND OHIO NOTES.

Philadelphia, Pa., Oct. 9, 1899.

MR. C. L. BUNDY, of the Philadelphia Electrical & Manufacturing Company, has returned to Philadelphia after an absence of several weeks for recuperation. His many friends will be gratified to learn that he has completely regained his health and is back at his desk again.

FARMERS OPPOSE TROLLEYS.—The proposed extension of the Chester Traction Company's lines from Chester to Rockdale has been abandoned because of the objection of some of the farmers along the route. The company will, however, build the line from Rockdale to Media.

PHILADELPHIA ELECTRIC CO.—Articles of incorporation of the Philadelphia Electric Company, with an authorized capital of $25,000,000, were filed at Trenton, N. J., Oct. 6. The company is authorized to manufacture and supply gas, electricity, light, heat, steam, compressed and liquefied air, power, ice, cold storage, etc. It will absorb the Pennsylvania Heat, Light & Power Company and the recently formed National Electric Company, and will ultimately control the electric lighting of Philadelphia. The controlling factors in the new concern are P. A. B. Widener and William L. Elkins; Thomas Dolan, president of the United Gas Improvement Company; ex-Democratic National Committeeman William F. Harrity, and Joseph McCall, president of the Pennsylvania Heat, Light & Power Company. The authorized capital of the Pennsylvania Heat, Light & Power Company and the National Electric is respectively $15,000,000 and $10,000,000.

SCRANTON TROLLEY FRANCHISES.—Judge Gunster has decided that franchises given to corporations to occupy city streets were not forfeited by the failure to carry out the provisions thereof within the time specified by the ordinances, unless the councils formally acted thereon when such period had elapsed. The decision was given in the case of the Scranton Traction Company, in which E. W. Clark & Co., of Philadelphia, are largely interested. The franchise originally granted to the Valley Passenger Railway Company, in 1893, provided that tracks must be laid within two years. The Valley people sold out to the Scranton Traction, and the latter did nothing with the franchise until two months ago. Then they put down tracks, covering six blocks, and when about to connect the tracks were stopped by the city authorities with an injunction. Judge Gunster holds that as the city did nothing while the work was progressing, giving at the time acquiescence in the work, it cannot now interfere.

Cleveland, Ohio, Oct. 7, 1899.

THE CLEVELAND, BEREA, ELYRIA & OBERLIN ELECTRIC RAILWAY COMPANY is preparing to extend its Berea line to Medina.

RAILWAY EXTENSION.—President W. E. Haycox, of the Galion & Bucyrus Electric Railway, has announced that his road is to be extended from Bucyrus to Upper Sandusky, via Nevada.

SUIT AGAINST THE WALKER COMPANY.—A suit against the Walker Company, of Cleveland, to secure judgment upon 15 promissory notes, aggregating $230,000, given by the Walker Company to the Westinghouse Electric & Manufacturing Company, was commenced in the Common Pleas Court, Cleveland, last Thursday. The plaintiff is Frederick P. Voorhees, to whom the notes were transferred without recourse by the Westinghouse Company. The notes were given during March and April, 1899, and were made payable in August. Five of the notes were for $25,000 each, one was for $15,000 and nine were for $10,000 each.

THE STRIKE of the telephone linemen in Cleveland against the Cuyahoga Telephone Company, the Reserve Construction Company and the United States Telephone Company was called off a few days ago, an amicable settlement having been effected between the Electrical Workers' Union and the officials of the companies mentioned. The strike was inaugurated July 20, in sympathy with the strike of the motormen and conductors of the Cleveland Electric railway, which is owned by the same stockholders as the telephone companies. About 350 men have been out since that time in various parts of the state. An agreement was signed whereby all the old employees were reinstated.

SANDUSKY ELECTRIC RAILWAY PURCHASED.—Mr. S. M. Bullock, of New York, representing an Eastern syndicate, has purchased the People's

Electric Railway, of Sandusky, and the Sandusky, Milan & Norwalk Electric Railway for $140,000 cash. The new company, which is to be known as the Sandusky, Milan & Norwalk Traction Company, has filed a mortgage securing bonds to the amount of $640,000. The mortgage was a trust deed to the State Trust Company, of New York, securing an issue of $4,000,000 gold bonds, payable in 30 years, and bearing 5 per cent. interest. The paper was signed by Frank Warren, president, and T. Pitt Cooke, secretary, of the new company.

INJUNCTION DISSOLVED.—Judge Williams, of the United States Court at Columbus, has dissolved the temporary injunction restraining the consolidation of Columbus street railway lines and the consolidation has been effected. The new company is known as the Columbus Railway Company, and includes the lines of the Columbus Street Railway Company, the Cross Town Railway Company and the Columbus Central Railway Company. The last mentioned line was recently purchased at commissioner's sale by W. S. Rowe, of Cincinnati, the object being to effect the combination. The officers of the new company are R. E. Sheldon, president; P. V. Burrington, secretary, and E. K. Stewart, general manager. Last Thursday the Columbus Railway Company filed a mortgage for $7,000,000, covering all the street railway property in the city. The mortgage is to the Union Savings Bank & Trust Company, of Cincinnati, and was given to protect an issue of 4 per cent. gold bonds, soon to be put out. This was the largest mortgage ever filed in Columbus.

Cincinnati, Oct. 5.

BULLOCK ELECTRIC MANUFACTURING COMPANY have put in a new 35-hp. motor for the Duhme Jewelry Company, on 4th Street.

ELECTRIC RAILWAYS PURCHASED.—The electric railways of Ironton, Ohio; Catlettsburg and Ashland, Ky.; Central City and Huntington, W. Va., have been purchased by an Eastern syndicate.

PRESIDENT GEORGE BULLOCK, of the Bullock Electric Company, returned from his vacation a week ago and left immediately for New York City, where he is at present. He is expected at home again on Oct. 22.

THE LAWTON-BEATTIE COMPANY has just finished putting in a handsome electric plant for the Ellington Piano Company of this city. The service is to take care of a 500-light circuit, motors for electric driving and other features. The same company has also wired the new plant of the American Type Foundry on Sixth Street. The Bullock Electric Company furnished the machines and motors, twenty-five in number.

THE TRIUMPH ELECTRIC people are jubilant over a decision rendered by the United States Court of Appeals last Tuesday. This decision affirms the judgment of the District Courts in the matter of the Westinghouse Electric & Manufacturing Company vs. The Triumph Electric Company, which denies the right of the first named company to interfere with the use by the last named of a certain style of motor or dynamo frame. The decision was given by Judge W. H. Taft.

MESSRS. COLDREN & BECK, proprietor of the Buckeye Electric Repair Works of Columbus, O., have recently moved from Vine Street to West Spring Street, where they have succeeded in getting a factory three times the capacity of their former one. The high class of work this company have done in repairing electrical machinery for the past few years has given them such a stand in the electrical field, that their factory is running night and day to keep up with orders.

MR. O. M. HUBBARD, who for the past five years has been the manager of the electrical department of the Bradford Belting Company, Cincinnati, O., has recently formed a partnership with Mr. F. D. Buskirk, and will deal in electrical supplies, factory and mill supplies and all kinds of belting. They will also bring out O. K. Insulating and Hot Surface Paint. With two such energetic and high classed business men as Mr. Hubbard and Mr. Buskirk this company certainly ought to be a shining light in the electrical field.

THE BULLOCK ELECTRIC COMPANY has just sold to Dick Kerr & Co., of London, England, ten 50-hp motors operating at 200 revolutions, to run their new electric plant in the English metropolis. A special quill shaft will be a feature of the installation. The September orders of the Bullock Electric Company amounted to sixty-one machines ranging from 1 to 300-hp. Among them were additional orders from the four large firms—Maryland Steel Company, Baltimore, third order; Consumers Park Brewing Company, Brooklyn, third order; Atlas Cement Company, Northampton, Pa., fifth order, and Missouri Lead & Zinc Company, Joplin, third order.

MASONIC ELECTRICAL ILLUMINATIONS.—Four or five of the local Knights Templar who are electrical men have arranged to give the members of the State Conclave which holds forth in Cincinnati Tuesday and Wednesday next, an electrical surprise. A sign, twenty feet in length, will be stretched across Fourth Street near the Grand Hotel containing the words in electrical illumination, "Hanselmann Commandery," and appropriate greeting, to be spelled out with the assistance of 400 incandescent lamps. Besides this there will be a number of miniature emblematic displays at the Grand Hotel and other prominent places. All this will be done by the half dozen local electrical men who are Knights Templars. Among these may be mentioned W. F. Hays, of the General Electric Company; E. M. Lawton, of the Beattie-Lawton Company; F. A. Kelly, of the General Electric Company; Sam Glover, of the Post-Glover Company, and John Pevear, of the General Electric Company, who is, by the way, the son of the only president the Thomson-Houston Company ever had.

## WESTERN NOTES.

Chicago, Ill., Oct. 7, 1899.

WESTERN ELECTRIC.—An interesting article appears in the Chicago *Evening Post* as to the growth of Western Electric Company, which beginning modestly in 1871 now has nearly 1,000,000 feet of floor space in its factories in Chicago alone. A large power plant of 3500-hp ultimate capacity supplies light, heat and power, and over 4000 employees are on the Chicago pay roll.

REFUSAL TO PAY FARE.—A test is being made at Racine of the question whether a passenger has a right to refuse to pay his fare on a street car if there is no conductor to receive it. Milwaukee Electric, which controls the Racine line, says that the business there will not warrant the employment of conductors, as the cars only earn about $10 a day each. When the people refused to deposit fares in the box provided for that purpose the company got an injunction which applies to all persons who may attempt to ride on the cars. This trouble is confined to the Racine lines and does not involve any part of the Milwaukee system nor the interurban road.

TELEPHONE COMPANIES COMBINED.—Representatives of a number of independent telephone companies operating in Michigan, Ohio, Indiana, Pennsylvania and Illinois, at a meeting in this city this week, formed the Independent Telephone Association of the United States. Another meeting will soon be held in Chicago for the purpose of electing officers and directors. It is expected that the Illinois Telephone & Telegraph Company, which owns a telephone franchise of Chicago, will enter the consolidation. Among those interested in the movement and in attendance at the conference were J. B. Hanna, S. P. Sherin, of Indianapolis; J. B. Hoag and Maximilian Reeber, of Cleveland; Judge J. M. Thomas, of Chillicothe; Drs. Tobey and Sennott, of the Illinois Independent Telephone Association; Corporation Counsel Flower, of Detroit; J. B. Ware, of Michigan, and H. A. Everett, of Cleveland. There may be a new American Bell Company when they get through, and then the fight will be really "on."

TELEPHONE IMPROVEMENTS.—One million dollars will be expended within the next year by the Chicago Telephone Company in improving the general telephone system of the city. Contracts have been drawn between the telephone company and the Jonathan Clark & Sons Company for the erection of five new telephone buildings, which will cost about $125,000. The buildings will closely resemble each other and will contain the operating appliances of the company in the districts of North, Lake View, West, Yards and Wentworth. Aside from the erection of the various new district headquarters, the main office, at the corner of Washington and Franklin streets, will soon be ready for occupancy, and large expenditures are being made by the company for underground and overhead plants and for the equipment of new offices, which are to be in every respect modern and convenient. Employment will be given to over 3000 people. More people are carried on the pay rolls at the present time than ever before in the history of the company. Applications for telephone service are pouring into the general offices at the rate of 800 per month, which is unprecedented. This demand is due in large measure to the advantages of the measured system.

TRACTION CONTROL.—It will not be many months, probably, before the Whitney-Widener-Elkins syndicate, of New York and Philadelphia, will gain control of the traction business of Chicago, comprising hundreds of miles of street trackage within the city limits and in the near suburbs. The syndicate has just offered $13,000,000 cash for the Northwestern "L" road, now almost completed from the heart of the city northward to Wilson Avenue, just south of Evanston, to which point it will be pushed in time. The Northwestern "L" is one of the roads controlled by C. T. Yerkes. It will join the Union Loop road, also under Mr. Yerkes' control, which encircles the central part of the city and extends northward through a paying territory five miles. Blair & Co., of New York, the house that headed the syndicate which financed the bond issue of $4,500,000 for the Northwestern "L," received the offer from the Whitney syndicate, the latter agreeing to assume the bonds and other liabilities. Aside from the bonds the road has $5,000,000 preferred and the same of common stock, and the offer made is equal to 100 on the preferred and 60 on the common, together with half a million accrued interest. If the deal is made the Union Traction Company will assume control of the line.

CAR FENDERS IN CHICAGO.—After the use of fenders on electric cars in Chicago for an average of about six months, the *Record* of this city has made an inquiry to determine their efficiency in lessening the liability to accident. It ascertained that about 72 per cent. of the persons struck during the six months escaped serious injury because of the use of the fenders. The seven fatal accidents resulted from the fender passing over the victims. The accidents of most serious consequences were distributed among the five or six different kinds of fenders in use, but the fender most in favor now with the street car men, after the trial, is the one that can be dropped to the track by a motion of the motorman's knee. The railroad officials generally opposed the attachment of the fenders as useless, and as liable to increase danger of injury because of their projection in front of the cars, but they are satisfied now that the fenders save enough lives to fully warrant their use. The author of the ordinance is disappointed, however. He believes that with the best fender and due diligence more than 75 per cent. of the people struck would be saved from injury.

CHICAGO'S TELEPHONE SERVICE.—One million dollars will be expended within the next year by the Chicago Telephone Company in improving the general telephone system of the city. Contracts have been drawn between the Telephone Company and the Jonathan Clark & Sons Company for the erection of five new telephone buildings, which will cost about $125,000. The buildings will closely resemble each other and will contain the operating appliances of the company in the districts of North, Lake View, West, Yards and Wentworth. Aside from the erection of the various new district headquarters, the main office, at the corner of Washington and Franklin Streets, will soon be ready for occupancy, and large expenditures are being made by the company for underground and overhead plants and for the equipment of new offices, which are to be in every respect modern and convenient. The buildings are to be completed and the new apparatus installed early next year, and the lines in the various districts will be transferred to them at that time. Orders were placed and arrangements made for the various pieces of real estate originally with the expectation of opening the offices this fall, but the manufacturers of the appliances, the Western Electric Company, on account of the unprecedented amount of telephone apparatus now being made, were unable to complete the switchboards.

Indianapolis, Ind., Oct. 7, 1899.

INCREASE OF CAPITAL.—The Indianapolis & Greenfield Rapid Transit Company has increased its capital stock from $100,000 to $300,000.

RAILWAY EXTENSION.—The stockholders of the Evansville Suburban &

Newberg Railway Company have filed notice of an extension of the line to Mitchell, Lawrence County.

MUNICIPAL OWNERSHIP.—The city council of Knightstown has declared in favor of municipal ownership of the electric light plant, bids for the construction of which will be opened during October.

TOWPATH PURCHASED.—Forty miles of the old Wabash and Erie towpath has been purchased south from Fort Wayne. It is believed an electric line will be built on this old way from Fort Wayne to Evansville.

MUNICIPAL OWNERSHIP.—The city of Goshen claims to present a clean example of the wisdom of municipal ownership of electric light and water works plants. The plan has been tried with great success, saving to the city $17,000 the first year.

VETO SUSTAINED.—The franchise recently voted to the Northern Traction Company by the council of South Bend was vetoed by Mayor Colfax. An attempt on Sept. 26 to pass the ordinance over the veto failed by a tie vote, the mayor deciding the tie. He insists that the franchise is valuable and should be paid for.

STREET RAILWAY SOLD.—By order of court Receiver Rockhill on Sept. 27 sold the Fort Wayne Consolidated Street Railway to George A. Garrettson, of Cleveland, Ohio, for $1,092,000. The company will be reorganized and it is said that the Robison Bros., of Cleveland, who own the common stock, are most likely to secure control.

TROLLEY VS. STEAM RAILWAYS.—The trolley lines now in successful operation between a number of towns and cities in the gas-belt region are cutting considerably into the business of the steam railroads in the same locality. A large number of passenger select the trolley line for the novelty of the ride and also because it is cheaper.

NEW ELECTRIC LINES TO ENTER INDIANAPOLIS.—General Manager McGowen, of the Indianapolis Street Railway Company, says arrangements have been made with his company to permit the Greenfield electric line to enter the city over the Irvington line and the Greenwood line to come in over the Shelby Street line from Garfield Park. Both companies report progress in construction and the probability of these and other lines being in operation in a few months.

AN AIR LINE TO FORT WAYNE.—Articles of incorporation of the Indianapolis & Fort Wayne Railway have been filed. The capital stock of the company is fixed at $100,000, with the understanding that the amount will be increased later on. The first board of directors consists of Crawford Fairbanks, Henry L. Smith, Alexander Taggart, S. E. Raugh and J. E. Roberts. The men interested in the enterprise say there is plenty of capital behind the scheme and declare that the road will either be built for steam or electricity as a propelling power.

THE BROWNWELL LINE.—The Muncie Interurban Railway Company, known as the Brownwell line, though not attracting much attention is making steady progress. This line is being built between Muncie, Hartford City and Dunkirk. Rights of way and franchises have all been secured. It is now decided to run this line in two branches. From Muncie to a point one mile east of Eaton. At that point the road will run in two directions—one branch will run to Dunkirk and the other to Hartford City. It is the purpose to have this line in operation by early spring.

INDIANAPOLIS CONNECTIONS.—The indications are that before Christmas two or more interurban electric lines will connect Indianapolis with outside cities and be in operation. The Henry road to Anderson and the Greenwood road are nearing completion and there promises to be no let-up until cars are running. No work has yet been done on the Plainfield road, though the officers say the road will be built. The two companies that propose to build to Martinsville are still busy with preliminaries and assure all inquirers that the road will be built and put in operation early in the coming year.

St. Louis, Mo., Oct. 7, 1899.

PEOPLE'S RAILWAY BONDS.—The bondholders of the People's Railway Company have been notified that $941.86 on each bond of $1000 is payable at the office of the St. Louis Trust Company. This is the money due them by the purchase of People's Railway by Brown Bros. syndicate.

ELECTRIC COMPANY INCORPORATED.—The Globe Electric Company filed articles of incorporation Sept. 27. The capital stock is $100,000, all paid. The stockholders are Gustav Heidel, George A. Clark, Gustav Miller and Samuel W. White.

CHANGE TO ELECTRIC POWER.—The work of converting the Broadway cable power house into an electric power station was begun Sept. 22. This is an indication that the changing of the Broadway line into an electric road will commence in the near future.

LEASED TO THE BELL COMPANY.—The Wayne County Telephone Company, which operates 225 miles of line in southeastern Illinois, has leased its lines to the Bell Telephone Company, which is putting in long distance instruments at all the principal points.

SUCCESS WITH A NEW TELEPHONE.—The new 1900 telephones now being sent out on trial by the Western Electrical Supply Company, with its new moisture and damp-proof transmitter subject to return at its expense if not satisfactory, is meeting with great success.

ELECTRIC LIGHT COMPANY RECEIVERSHIP.—A special despatch from Sycamore, Ill., states that Cassius M. Conrad has been appointed receiver of the Sycamore Electric Light Company on the petition of W. V. Henrie, one of the stockholders. Mr. Conrad has been ordered to file a bond in the sum of $14,000.

RAILWAY FRANCHISE SECURED.—The Central Belt Line Railway finally secured a franchise in the County Court Oct. 4 to operate an electric road through the county and the other contestants—the St. Louis County Belt Railway, the Creve Coeur Lake County Railway and the Terminal Belt Company, of St. Louis, were rejected.

A NEW ELECTRICAL ENTERPRISE FOR ST. LOUIS.—Advices have been received here that the National Light & Power Company, of New York, with a capital of $15,000,000, will locate here to compete with companies here in every application of electricity. It has a new means of generating electricity, with chemicals in a capsule, according to report.

ELECTRIC LINE TO FERGUSON, MO.—Mr. J. B. C. Lucas and J. D. Houseman, president and manager, respectively, of the Wellston, Creve Coeur & St. Charles Railway Company, appeared before the St. Louis county court Sept. 27 and requested permission to build a branch from the road now being constructed to Ferguson. The petition will probably be granted.

INCREASE OF CAPITAL STOCK.—At a meeting of the stockholders of the St. Louis Transit Company last week it was voted to increase the capital stock from $3,000,000 to $20,000,000, as has been outlined in the plan of consolidation of the street railways. The St. Louis Transit Company has no bonded or other indebtedness and no preferred stock.

WESTERN ELECTRICAL SUPPLY COMPANY.—This company reports that in no department of its business has the effects of the good times been felt so much as in the street railway department. This department was added a year ago, and now has the largest strictly jobbing trade in the west. The company carries in stock the largest line of street railway supplies in the west.

THE ST. LOUIS, KANSAS CITY & COLORADO RAILWAY made application to the county court Sept. 27 to operate an electric car line from St. Louis city limits to Clayton, the county seat. The franchise was drawn up in compliance with the request and wishes of the county property owners that there shall be no freight cars in operation. The St. Louis, Kansas City & Colorado already has rails to the Meramec road, now utilized by its steam line. The court will act Nov. 12.

CONTRACT FOR GENERATORS CLOSED.—General Manager Jilson J Coleman, of the United Railways Company, closed a contract last week with the General Electric Company for four large direct-connected generators to replace old generators. They will be placed in the North End power house, and will be ready for work about the middle of November. Two engines and two generators have been placed in the main power house, in course of erection at Park and Vandeventer Avenues, where 20,000-hp will be developed.

BIG FRANCHISE.—John H. Blessing, as president of the St. Louis, Clayton & St. Charles Railroad Company, appeared before the County Court at Clayton, Oct. 2, and asked for a franchise, which is the largest for an electrical line ever asked for in the Court. The projected route runs over twenty miles in the county and crosses over twenty public roads. The cost of riding over the entire route, together with transfers, will be 40 cents. The company agrees to pay into the county treasury $1,000 thirty days after receiving the franchise, and $1,000 per year thereafter. It promises to complete the line within five years after the acceptance of the franchise. There is a rumor that the United Railways Company is behind it.

Minneapolis, Minn., Oct. 7, 1899.

WAUKEGAN HAS LOCAL CARS.—Local street car service in Waukegan was begun recently by the Chicago & Milwaukee Electric Railway Company, which put on a car running from the north end of the line to the Chicago & Northwestern station. The service will be extended further north, and also to the West Side, until a full local service is secured.

DISSOLUTION OF PARTNERSHIP.—The firm of W. I. Gray & Co., electrical contractors and consulting engineers, has been dissolved. Mr. Gray will continue business under the firm name, with offices in the Sykes Block, Minneapolis. Mr. A. H. Savage has accepted the agency of the Fort Wayne Electric Works, and has offices in the Germania Life Building, St. Paul.

STORAGE BATTERY CONTRACT LET.—At a meeting of the court house and Minneapolis city hall commission Sept. 25 a contract was let to the Electric Storage Battery Company, of Philadelphia, for a new plant for the court house and city hall, to be installed at a cost of $8600. The new plant will consist of sixty-two 2000 ampere-hour cells, each cell having 13 positive and 14 negative plates, 15½ by 15½ inches square. The present plant, which consists of (21 plates) 1600 ampere-hour cells, has proven itself to be too small to stand the drain of two Sprague electric elevators, which are supplied with current from the batteries and the charging generator. The chief trouble arises from the "mud" which collects in the bottom of the cells and finally short circuits them. Ex-County Surveyor Abbott entered a protest against the letting of a contract for the storage batteries on the grounds that the present ones are proving a great expense, and cost more than would a properly operated steam plant. There are some members of the commission who still hope to see hydraulic elevators used in the court house.

Austin, Texas, Oct. 6, 1899.

ELECTRIC LIGHT FOR TEPIC, MEXICO.—The contract has been let for the installation of an electric light plant in the city of Tepic, Mexico. This city is near the Pacific coast of Mexico and is remote from railway transportation.

NEW TELEPHONE BUILDING.—The Southwestern Telegraph & Telephone Company has completed its handsome new building at Austin, Texas. This company now owns fine office and exchange buildings in all of the principal cities of Texas.

THE FIRST AUTOMOBILE IN TEXAS.—Mr. E. H. R. Green, president of the Texas Midland Railroad, has ordered an automobile and as soon as the vehicle is completed he will have it shipped to Terrell, Texas. He is the first person in Texas to purchase a horseless vehicle.

FRANCHISE TAXATION.—The board of county commissioners of many counties of Texas have become afflicted with the craze of assessing the franchises and other alleged intangible property of corporations. The Southwestern Telegraph & Telephone Company seems to be the special object of many of these boards of commissioners in the matter of franchise assessment. The Dallas county commissioners have assessed the franchise of that company at $900,000 for the year 1897 and at $1,800,000 for the year 1899. The Travis county commissioners have assessed the franchise of that company at the high rate of $450,000 per annum for the past three years.

## SOUTHERN NOTES.

Baltimore, Md., Oct. 7, 1899.

CONTRACT FOR NEW POWER PLANT.—The contract for erecting four of the buildings of the new plant of the United Railways & Electric Company on the site of the Carroll estate, in southwest Baltimore, has been awarded to Mr. John Waters. The buildings to be erected at once include a car barn, paint shop, erecting shop and storage house, at a cost of about $550,000. The contract for the other buildings, which will include a motor-erecting shop, cabinet shop, mill shop, power house, two machine shops, armature room and two blacksmith shops, will be awarded as soon as the plans and specifications are completed by Messrs. Baldwin & Pennington, architects, under whose supervision the buildings will be erected. The entire cost of the buildings and equipment will be about $1,000,000. The plant will cover more than 70 acres, or eight city blocks, and will be the most complete of its kind in the United States. It is the intention of the United Railways & Electric Company to concentrate all of its repair work there and to build and equip its own cars and motors. Machinery of the latest pattern will be installed.

## CANADIAN NOTES.

Montreal, Quebec, Oct. 7, 1899.

MANITOWANING, ONT.—B. H. Turner is preparing to introduce a local telephone system.

VICTORIA, B. C.—Tenders will be invited at once for enlarging the civic electric light station.

NIAGARA FALLS, ONT.—Steps are being taken to rebuild the power house of the Niagara Falls Park & River Railway.

CHATHAM, ONT.—Mayor Smith is negotiating with eastern capitalists for the construction of an electric railway in this city.

OTTAWA, ONT.—The Ottawa Power Company has been formed, with a capital of $250,000. A. W. Fraser and M. C. Eddy are interested.

THE CITY OF WINNIPEG has adopted the Western Electric system of arc lighting and has installed a complete plant for street lighting under municipal control.

ST. HYACINTHE, QUE.—The St. Hyacinthe Electric Railway Company is seeking incorporation, to build an electric railway, telephone, telegraph lines and bridges.

ST. CATHERINES, ONT.—A project for an electric railway from this city to Wellandport, via Fonthill and Pelham, is under consideration. Buffalo capitalists are interested in the project.

SUSSEX, N. B.—The Sussex & Hammond Telephone Company is seeking incorporation, to build a telephone line from Sussex to Jeffery's Corner and other points. O. P. King and R. B. Harmer are interested.

QUEBEC, QUE.—As soon as the works of the Canadian Electric Light Company are completed it is the intention to operate the Chaudiere Valley Railway Company by electricity. Other lines will be constructed in the counties of Levis, Bellechase, Dorchester and Lotbiniere.

ST. CATHERINES, ONT.—The Niagara Central Railway is about to be extended to Port Dalhousie, the company having decided to proceed with the work at once. The existing line will be converted into an electric road.

PORT ARTHUR, ONT.—The electric railway and light commissioners have recommended the council to authorize the installation of a water power plant at Current River. The plant is to have a capacity of 300-hp, divided into 200-hp for lighting and 100-hp for railway purposes, at a cost not exceeding $5000.

PORT STANLEY, ONT.—The Port Stanley Electric Railway Company has applied to the Ontario government for a charter to build an electric railway from Port Stanley to St. Thomas and London. Should the charter be granted it is proposed to commence work at once. The London & Port Stanley Gravel Road Company is the promoter.

# General News.

## THE TELEGRAPH AND TELEPHONE.

CYNTHIANA, KY.—The Cynthiana Telephone Company will increase its capital stock from $2100 to $3600.

WILLS POINT, TEXAS.—L. D. Brannon, of Commerce, is establishing a telephone exchange at Wills Point.

WAVERLY, TENN.—The Humphreys County Telephone Company has been incorporated with a capital stock of $1000.

WACO, TEXAS.—The long distance lines of the Southwestern Telegraph & Telephone Company at Waco, Texas, were formally opened.

KEYSER, W. VA.—The Union Telephone Exchange, recently opened, is already projecting three toll lines. C. W. Siever is general manager.

FARMVILLE, VA.—W. P. Venable and S. P. Vandersloce have incorporated the Farmville Telephone Company, with a capital stock of $5000.

FLEMINGSBURG, KY.—The Fleminsburg Telephone Company has been incorporated by J. H. Powell, J. M. Baldwin and others. Capital stock, $2500.

NEWARK, N. Y.—The Newark Telephone Company, whose owner and manager is W. H. Kelly, commenced business February, 1899, and has 35 miles of toll line.

AFTON, VA.—The Nelson Telephone Company have sold out to the Mutual Telephone Company, of Staunton. This line will be put in good shape and connected with the Staunton line.

MARSHALL, MICH.—A telephone war is being waged here between the new Saline County Company and the Missouri & Kansas Company. Rates are cut to 50 and 75 cents a telephone per month.

BARBOURSVILLE, KY.—J. W. Hunter, of Chattanooga, Tenn., secretary of the East Tennessee Telephone Company, has received a franchise for the construction of a telephone system at Barboursville.

LITTLE ROCK, ARK.—The American Telephone & Telegraph Company has completed its lines into Little Rock, where connection is made with the wires of the Southwestern Telegraph & Telephone Company.

BAY CITY, TEXAS.—The Wharton & Bay City Telephone Company has been incorporated, with a capital stock of $5000, by C. D. Kemp, Gerard A. Harrison and Frank Rugoly, for the construction of a telephone system.

BOWLING GREEN, OHIO.—The Bowling Green Telephone Company has been formed to build and operate a telephone exchange. Capital, $15,000. Incorporators, J. G. Hickox, K. V. Murray, F. A. Baldwin, all of Bowling Green.

BOONSBORO, ARK.—The Boonsboro & Stillwell Telephone Company has been incorporated, with J. C. White, president; J. A. Robinson, vice-president; A. R. Carroll, secretary, and J. S. Edmiston, treasurer. Capital stock, $2500.

TRINITY, TEXAS.—John H. Traylor and J. T. Elliott, of Dallas, Texas, and James H. Allen, of St. Louis, Mo., have incorporated the Southwestern Texas Telephone Company for construction of a line from Trinity to Corrigan.

HENDERSON'S X. ROADS, TENN.—The Cumberland Telephone & Telegraph Company has completed a telephone line from this place to Watertown via Greenvale and Statesville. Also connected the line at Cainesville to Murfreesboro.

CLAY CITY, ILL.—The Wayne County Telephone Company, which operates 225 miles of line in southeastern Illinois, has leased its lines to the Bell Telephone Company, which is putting in long distance instruments at all the principal points.

CHATTANOOGA, TENN.—The name of the new company, organized in opposition to the East Tennessee Company, is the Citizens' Telephone Company. C. D. Mitchell, president; F. Miller, vice-president; A. S. Glover, secretary; E. E. Meredith, treasurer.

OMAHA, NEB.—Because the state board of transportation has refused to force the Nebraska Telephone Company to reduce rates, the citizens of Omaha are arrainging to organize a consumers' company and enter the field as active competitors of the old Bell people.

CHATTANOOGA, TENN.—The Chattanooga Telephone Company has been organized for the establishment of a telephone exchange, with C. D. Mitchell, president; Frank Miller, vice-president; A. S. Glover, secretary, and E. Meredith, treasurer. Capital stock, $150,000.

LINCOLN, NEB.—The supreme court has decided against the Nebraska Telephone Company in the suit to enjoin the state board of transportation from lowering the telephone rates of the state. The legislature, in 1897, gave the board power to regulate telephone rates.

DETROIT, MICH.—The Wohlgemuth Automatic Telephone Holder Company has filed articles of incorporation. The capital stock is $10,000, fully paid in, and the stockholders are Moses Wohlgemuth and Benjamin Jacobson, 499 shares each, and Martha Wohlgemuth, two shares.

COLUMBUS, GA.—An ordinance has been introduced in the city council giving the Southern Bell Telephone Company the privilege of establishing an underground system of wires in this city. The Southern Bell Telephone Company has decided to improve greatly its Columbus exchange.

FIRE ISLAND, N. Y.—Experiments in wireless telegraphy are to be made off this place for the government by Sergeant W. R. Taylor and Carl Kingsley. It is said the Marconi system will be used. It is proposed to conduct the experiments between the lightship and the marine observatory at this place.

FREEPORT, PA.—A local telephone company has been organized here with these officers: President, J. H. Shoop; secretary and treasurer, G. B. Findley; directors, J. H. Holmes, R. B. McKee, G. M. Hill, Dr. J. T. McCulloch and R. W. Shoop. The electric light plant has been purchased from J. L. Long and the poles and wires will be utilized.

PITTSBURG, PA.—Rutan & Russell have made plans for the new exchange building of the Pittsburg & Allegheny Telephone Company, to be located at Seventh Avenue and Fountain Street. The building will be three stories high, of brick fireproof construction and hardwood finish. Its estimated cost is about $50,000. The building is to be finished about July 1, 1900.

SEATTLE, WASH.—Superintendent H. S. Prichett of the United States coast and geodetic survey announces that he will make a new and somewhat novel use of the wireless telegraphy. Next season the United States steamship Pathfinder will be sent to Alaskan waters to survey the islands of the Aleutian grops near Unimak Pass. The Pathfinder was built a year ago at Elizabeth, and equipped with the latest apparatus, appliances and instruments, including apparatus for the new system of telegraphy.

## ELECTRIC LIGHT AND POWER.

CORALVILLE, IA.—The $25,000 electric light plant at Coralville has been completed.

UNION, IND.—The electric light plant has been sold for $8000 to Mr. Wm. Haas, of Waynetown, Ind.

MINOOKA, PA.—The Lackawanna Township Electric Light, Heat & Power Company has been formed with a capital stock of $6000.

ST. LOUIS, MICH.—At the special election held on Sept. 25 the proposition to bond the city for $10,000 to build an electric lighting plant was carried.

KENOSHA, WIS.—The Kenosha Light & Power Company will install new apparatus in the spring. The capital stock is $25,000, and the officers are W. H. Schott, president; C. J. Wakeman, secretary and treasurer.

PRESCOTT, ARK.—The power house operating the city electric light and water plant was totally destroyed by fire on the night of Sept. 29. The power house was valued at $8000, with insurance of $6000.

PANA, ILL.—The Pana Electric Light Company's property has been sold to H. J. Freolicht, S. K. Gregg, J. Rawlins and others of Chicago, Ill., for $75,000. This takes in the Pana Telephone Exchange and other real estate.

SYCAMORE, ILL.—Cassius M. Conrad has been appointed receiver of the Sycamore Electric Light Company on the petition of W. V. Henrie, one of the stockholders. Mr. Conrad was ordered to file a bond in the sum of $14,000.

NEW ALBANY, IND.—The Jeffersonville city council has contracted with the Wayne Construction Company, of Chicago, for an electric light plant for $40,000. The plant is to be completed Feb. 1, and after a term of years will become the property of the city.

MURRAY, KY.—An electric lighting plant, with a generator of 35-kw capacity, has been installed, and arc lights are to be furnished to the town at $72 per year each. Messrs. Gathir and Radford are the promoters of the enterprise, both being local business men.

PHILADELPHIA, PA.—The Narberth Heat & Light Company intends erecting a new electric light plant adjoining its present building at Narberth, Pa., and is considering preliminary plans and specifications for the same. Details will be given when ready for bids.

MINOOKA, PA.—The Lackawanna Township Electric Light, Heat & Power Company has been formed to supply light, heat and power. Capital, $6000. Incorporators: P. Mullin, M. H. McDonough, J. Powell, all of Minooka; T. F. McDonough, J. J. Walsh, both of Scranton.

OSCEOLA, IOWA.—The city council at Osceola has entertained a proposition from an outside corporation to put in a system of water works and a lighting plant at a cost of $45,000, the city to be bonded to that amount. The proposition will be submitted to the voters at an early date.

WASHINGTON, N. J.—The Washington Electric Light & Power Company, principal office 420 Summer Avenue, Newark, N. J., has been formed to manufacture electricity for light, heat and power. Capital, $150,000. Incorporators, Samuel A. Foster, Abraham L. A. Himmelwright, of Newark, N. J.; Henry W. Schloss, New York City.

SAGINAW, MICH.—The Bartlett Illuminating Company has been reorganized and has purchased the Saginaw Electric Light & Power Company's plant on the west side, consolidating the two plants. J. H. Waterman, of Boston, is president of the new company; Charles A. Khuen, of Saginaw, is treasurer; John Terman, of this city, is general manager, and C. W. Ricker, Buffalo, consulting engineer. The plants will be operated from one station on the east side, and the power circuit will be greatly increased. It is expected that nearly $50,000 will be expended in improvements.

WILLIAMSPORT, PA.—The Edison Electric Illuminating Company of this city has been sold for $120,000, and the cash has been paid over to the stockholders. The city of Williamsport has just awarded the contract for lighting the streets with electricity to Thomas Lynch, of Philadelphia. His bid was ridiculously low, and nobody expected him to file a bond and contract. He has not done so, and the Edison Company, which has just been sold, being the next lowest bidder, would have received the contract to do it, but now the Lycoming Improvement Company, which was the highest and only other bidder, has, it is believed, bought out the Edison Company in order to get the contract and do away with all opposition.

## THE ELECTRIC RAILWAY.

DANVILLE, ILL.—E. H. Nebeker, of Covington, Ind., has secured a franchise for an electric railroad between Danville and Georgetown, Ill., a distance of twenty miles.

NORTHAMPTON, MASS.—The temporary organization has been effected for the construction of an electric road from Northampton, Mass., to Holyoke, passing through East Hampton.

DUNKIRK, N. Y.—The Dunkirk & Hickoryhurst Electric Railroad, to operate through the city of Dunkirk to Point Gratiot, Chautauqua County, a distance of 7 miles, has been incorporated. Its capital stock is $50,000.

WILKINSBURG, PA.—The ordinance granting the Wilkinsburg & East Pittsburg Electric Railway, a branch of the Monongahela Street Railway Company, permission to use the Turtle Creek streets, has been voted down.

CINCINNATI, O.—Orders requiring every motorman in the employ of the Cincinnati Street Railway Company, which operate all the trolley lines in this city, to stand a physical examination, have been posted at the different barns.

TORONTO, O.—George A. Maxwell, of Steubenville, has secured a right of way from abutting property owners here to construct a street railway from the lower part of town to the north end. The railway is to be extended to Empire soon.

WILKINSBURG, PA.—The Wilkinsburg, Frankston Avenue & Verona Street Railway Company has been formed. Capital, $54,000. Incorporators, J. Guffey, M. C. Dwyer, A. L. Schultz, J. C. Fisher, all of Pittsburg; J. F. Leffer, Tarentum.

FREDONIA, N. Y.—The Fredonia & Lily Dale Electric Railroad, with a capital of $150,000, has been incorporated. It is to be operated through the village of Fredonia to and through the Assembly Grounds at Lily Dale, a distance of 7 miles.

NIAGARA FALLS, N. Y.—Commissioners Dow, Porter and Kingsford signed the franchise which the full board at its last meeting at New York granted to the International Traction Company, in which permission is given to lay tracks on Riverway, and in so doing complete the belt line.

OIL CITY, PA.—At a meeting of the select council of this city an ordinance granting a frachise to the Citizens' Traction Company to construct and operate a new electric street railway was passed. A franchise was also given the Mercer Telephone Company to operate in this city.

PHILADELPHIA, PA.—A syndicate of Philadelphians have purchased the Doylestown & Willow Grove Electric Railroad and intend to double track the road. The office of the company is at Doylestown and estimates for construction work will be taken at that point as soon as ready to go ahead.

FALL RIVER, MASS.—Articles of association have been advertised of the Fall River Shore Line Street Railway Company. The concern plans to build a trolley road in certain localities within the city limits not now accommodated and ultimately to extend to Tiverton, R. I., and Westport, Mass.

GOSHEN, IND.—The Goshen & Indiana Traction Company has been granted a franchise to traverse the highways of this county from the Lagrange County line to this city. Franchises have already been obtained in Steuben and Lagrange Counties and the building of the road will immediately begin.

CAMBRIDGE SPRINGS, PA.—The Cambridge Springs Street Railway Company has been formed for the purpose of maintaining and constructing a street railway. Capital, $30,000. Incorporators, W. D. Rider, W. D. Rider, Jr., O. G. Benson, Cambridge Springs; F. P. Ray, Meadville; E. W. Nichols, Franklin.

COVINGTON, KY.—Articles of incorporation of the Covington, Cincinnati & Erlanger Street Railway Company have been filed. The capital stock is $250,000, divided into shares of $50 each, nearly all of which has been subscribed. The incorporators are the same as those now in the C., N. & C. Street Railway Company.

DANVILLE, VA.—The city council at a special meeting unanimously adopted an ordinance embodying a new and extended franchise to the Danville Street Car Company. The new franchise was asked by the old company in order that it might sell its line to the new $200,000 syndicate headed by William J. Payne, of Richmond.

MT. PLEASANT, PA.—Attorney H. L. Robinson has received a notification from W. W. Staub, of Scottsdale, accepting the option of the Uniontown Street Railway Company. The sale includes 700 shares of outstanding stock at $50 per share. The purchasers expect to connect all the street railways between Mt. Pleasant and Uniontown.

EAST ST. LOUIS, MO.—The Illinois secretary of state has licensed to incorporate the Granite City, Venice & East St. Louis Railway Company, to build an electric railway between the points named. The principal office will be at Venice. The capital stock is $125,000, and the incorporators are E. J. Spence, Fred E. Allen and J. S. Tritle.

CLEVELAND, OHIO.—S. M. Bullock, of New York, has purchased for an Eastern syndicate the People's Electric Railway, of Sandusky, and the Sandusky, Milan & Norwalk Electric Railway, for $140,000 cash. On Oct. 3 the new company, known as the Sandusky, Milan & Norwalk Traction Company, placed a mortgage of $400,000 on file in the Huron County recorder's office.

NEW CASTLE, DEL.—The completion of the line of the New Castle & Delaware City Electric Railway Company between the points named in the title of the company will complete a stretch of trolley road which will be one of the longest in the country. There are longer ones which have sections missing, but this will be an unbroken line, and will extend for about 60 miles.

BIRMINGHAM, ALA.—The roundhouse, car shed and railway shops of the Birmingham Electric Railway Company have been burned. Loss, $85,000, well covered by insurance. Five engines, six trolley cars and 11 coaches destroyed; also a large amount of machinery, tools, etc. The electric current had just been turned off and the motor cars could not be moved out of the roundhouse.

BOSTON, MASS.—The Norfolk Central electric road has been formally absorbed by the syndicate which controls 57 electric roads in eastern Massachusetts. Superintendent John S. Jennings handed over to R. S. Rounds, of the West Roxbury & Roslindale road, the property of the Norfolk Company. There remains but one road in this vicinity, the Norfolk Southern, indepedent of the syndicate.

BUFFALO, N. Y.—The Buffalo & Erie Electric Railroad, a street surface road with a capital stock of $1,000,000, has been incorporated to be operated from Buffalo to Erie, Pa., a distance of about 70 miles. The directors are: C. V. Boughton, A. C. Schmidt, Thomas C. Fremyear, Paul Herner, W. A. Calhoun, A. Schmidt, Sr., J. F. Weber, H. P. Queal, all of Buffalo, and W. W. Cole of Elmira.

HOUGHTON, MICH.—Stone & Webster, prominent electrical engineers of Boston, have been granted a 30-year street railway franchise in Houghton, and will secure the same in Hancock. The promoters of the line will build a belt electric line in Houghton County, and intend eventually to build to Ontonagon, 50 miles to the southward, at the southern end of the Michigan copper district.

NEWARK, N. J.—David Young, on behalf of the North New Jersey Street Railway Company, of which he is second vice-president, has declined the franchise granted by Montclair for the construction of a branch through Orange Road to connect Orange and Montclair. The company will not accept the limited franchise of 40 years, and objects also to the time limit set for the completition of the road.

SEATTLE, WASH.—The Boston syndicate of capitalists who have secured options on six of the street railway lines in this city have closed the deal for the purchase of four. The lines are the Madison Street Cable Railway Company, the Union Trunk Line, the West Street and North End Electric Railway and the Seattle Traction Company. Improvement work will be commenced at once. The purchase price aggregates $4,000,000.

MASONTOWN, PA.—The Masontown & New Salem Railroad Company has been granted a charter. The road will he eight miles long and runs from Masontown to New Salem in Fayette County. The incorporators are John P. Brennen, James A. Cowan, Charles P. Parker, Wilbur M. Judd, E. J. Buffington, Charles H. Foote, E. Shearson, A. F. Cooper, J. Q. Van Swearingen, C. H. Hosler, Selwyn M. Taylor and John C. Neff.

COLUMBUS, O.—Judge Williams has dissolved the temporary restraining order preventing the consolidation of Columbus Street Railway and Columbus Central Railway. The opposition gave notice that they would bring the matter up in new shape, but the Columbus Railway Company met and voted to purchase both lines; this gives authority to the Columbus Railway Company's directors to buy both lines at any time they may fix.

CHATTANOOGA, TENN.—J. C. Shaffer, a prominent capitalist of Chicago, has secured option on all the street railways, inclines, electric light plants and the gas plant in this city. He is representing a syndicate of New York and Chicago capitalists, who are buying street railway interests in the South. Mr. Shaffer's option is for thirty days, and in that time, he states, they will buy, and over a million dollars will be expended in improving the consolidated interests.

KANSAS CITY, KAN.—The state board granted a charter to the Kansas City, Lawrence & Topeka Railway Company. The capital stock of the new company is $2,000,000. The company is chartered for 99 years, to lay a standard gauge steel track railway with equipments for operating cars by electricity or other motor power from Kansas City, Kan., to Topeka, by way of Bonner Springs and Lawrence through the counties of Leavenworth, Douglas and Shawnee.

ELIZABETH, N. J.—The new trolley road of United States Senator Kean began operation last week in this city. The line is now two and a half miles long and runs between Broad Street and the Staten Island Ferry at Elizabethport. The first car to run over the road was decorated and carried Senator Kean, his brother, Julius Kean; Alderman Patterson, Superintendent Smith of the North Jersey Traction Company, Supervising Constructor Turner, and a party of invited guests.

DETROIT, MICH.—The city council granted a 30-year franchise to Messrs. Jackson and Harrah, of Detroit, to operate an electric line between Monroe and Toledo, the work to be commenced not later than Nov. 15, 1899, and the road to be completed by Aug. 1, 1900. They also have an option on a line to Detroit to be completed by Aug. 1, 1901, option to take effect if the other road is completed on time. The promoters will also run a line from the city to the piers on Lake Erie beach.

MEDIA, PA.—The Philadelphia & Delaware County Trolley Company, now operating a line over the Baltimore pike from Angora to Media, in its move to extend the road on from Media to the Black Horse, Lima, Rockdale and Lenni, is rapidly getting the right of way along the proposed extension. At a meeting of the citizens of Middletown a resolution was passed empowering the supervisors to grant the trolley people the right to lay tracks on the route proposed and also to permit the laying of T rails.

DANVILLE, VA.—The city council, having passed an ordinance granting a new franchise to the Danville Street Car Company, a syndicate headed by William J. Payne has closed an option by which they became the purchasers of the property. This syndicate will expend $250,000 in equipping the line, extending it to the north side of the river and on other streets on the south side. They will take possession and begin the work at once. The new company promises that Danville shall have a strictly first class, up-to-date road.

GREEN BAY, WIS.—At the close of the council meeting at which the franchise of the McCartney street railway line was repealed and the franchise of the Fox River Electric Railway Company extended so as to cover the lines of the McCartney road, J. H. Tayler, manager of the McCartney road, said that the action of the council was virtually a completion of the sale of the east side line and that the transfer to the east side company would undoubtedly be made in a very short time, as soon as a few minor details of the sale can be settled.

HOUGHTON, MICH.—The Houghton County Street Railway Company has secured a charter which is on sufficiently liberal lines to permit the road to handle traffic successfully, and the work on the actual construction of the line will begin about Oct. 1. A trunk line between Houghton and Calumet will be built first and a belt line about the county completed next season. It is possible the new company may take over the existing electric lighting plants in the copper district. The cost of the electric lines complete will be nearly $1,000,000.

COLUMBUS, OHIO.—The consolidation of all the street railway lines of Columbus was completed on Oct. 2. The property of the Columbus Street Railway Company, the Cross Town Street Railway Company and the Columbus Central were transferred to the new Columbus Railway Company. The new company then executed a mortgage of $7,000,000 to the Union Savings Bank & Trust Company, of New York. R. E. Sheldon is the president and P. V. Burrington secretary of the new company. E. K. Stewart will be the vice-president and general manager.

## THE AUTOMOBILE.

HARTFORD, CONN.—Ground has been broken for the new factory building of the Columbia & Electric Vehicle Company in the rear of the company's present buildings at the junction of Park and Laurel streets. The building will be 270 by 70 feet and four stories high. It will be used for storage purposes, wiring, painting and carriage assembling. The company is also building an addition to its blacksmith shop.

MINNEAPOLIS, MINN.—A company, with a capital stock of about $250,000, is in process of formation here, and will operate the electric cabs. S. N. Smith is the projector of the scheme. In a general way the company's operations will be the same as that of a livery stable. There will be a central cab parlor, where the vehicles may be rented for ordinary purposes. The vehicles will be operated by experienced men. A charging station will be established at a central location, and there will be substations in various parts of the city, where owners of vehicles may have the batteries recharged from time to time.

CITY OF MEXICO, MEX.—An important electric vehicle concession has been granted by the city government to Charles L. Seager, of New York, who acts for the Electric Vehicle Company, in which are interested Messrs. Whitney, Widener and Elkins. The concession is for a complete public coach service of the latest pattern, to run through the principal streets and in the populous suburbs of this capital.

## EDUCATIONAL.

THE OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE, at Stillwater, Okla., is to have the equipment of its electrical engineering laboratory further increased this fall by the addition of a direct-connected engine and generator, and a motor of 30-hp to drive the lineshaft for the smaller dynamos. Other apparatus is to be added, including instruments for fine electrical measurements. The college is also to erect a foundry. Prof. R. E. Chandler is in charge of the engineering course, with Mr. Carl E. Besser as assistant.

THE AMERICAN SCHOOL OF CORRESPONDENCE, Boston, Mass., offers special advantages to secure an education, claiming that its students are enabled to pass government examinations. The object of the school is to give the busy man a thorough training in steam, electrical and mechanical engineering by mail. The electrical engineering course is carefully supervised by experts and is in close touch with the developments of the age. The instruction is carefully graded, thoroughly practical and scientific, and is intended to give electricians a complete technical training. The student's work is carefully inspected by well known experts and instructors of the school, who are all graduates of the leading technical schools. The school has been warmly indorsed by many of the leading educators and engineers throughout the country. Electrical men will do well to write for a handbook.

UNIVERSITY OF ILLINOIS.—Under Prof. W. S. Aldrich, at the University of Illinois, Urbana, a number of new courses in the department of electrical engineering have been added in the fields of electro-metallurgy, alternating current working and polyphase testing and electric lighting and power plants. The equipment of the electrical engineering laboratory is being continuously increased for regular and advanced work in these branches. The four years' undergraduate course has been made elective for the last year and a half—that is, a student may elect his further work in: (1) regular electrical course; (2) electro-physical course; (3) electrochemical course. The degree of electrical engineer is given only after completion of five years of work. The fifth year is devoted entirely to special work. The principal or primary subjects are elected from the advanced electrical engineering course; the secondary or subordinate subjects are elected from the advanced courses in mathematics, physics, chemistry and mechanical engineering.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—On Wednesday, Sept. 27, the exercises of the Massachusetts Institute of Technology began. Since the end of the last term some changes have been made in the faculty. Adolph Rambeau, Ph. D., has been made professor of modern languages, and has charge of that department. Arthur A. Noyes, Ph. D., formerly associate professor of organic chemistry, has been made professor of theoretical and organic chemistry. Jerome Sondericker, C. E., formerly assistant professor of applied mechanics, has been made associate professor of applied mechanics. Allyne L. Merrill, S. B., formerly assistant professor of mechanism, has been made associate professor of mechanism. Edward F. Miller, S. B., who was assistant professor of steam engineering, has been made associate professor of steam engineering. Carleton A. Read, S. B., who was an instructor in mechanical engineering, has left to take charge of the mechanical engineering department in the New Hampshire College at Durham. George V. Wendell, Ph. D., has returned from three years' study in Germany, and resumes his duties as instructor in physics. Frederic H. Keyes, S. B., and Alexander W. Moseley, S. B., have left to take up professional work. Frederick A. Hannah, S. B., has accepted a position in the mechanical department of the Brooklyn Polytechnic Institute. Capt. John Bordman, Jr., who was instructor in military science, is on his way to the Philippines with the 26th U. S. Infantry, of which he is the regimental adjutant. Myron L. Fuller, who was an assistant in geology, has been made an instructor in geology. The following men have been made assistants: Henry E. Andrews, A. B., in English; Alvan L. Davis, S. B., in mining engineering; F. L. H. Kimball, S. B., in mining engineering; Miles S. Sherrill, S. B., in analytical chemistry; Etheredge Walker, S. B., in mining engineering; William S. Newell, S. B., in mechanical engineering; George H. Riker, S. B., in mechanical drawing, and Frank R. Swift in mechanical engineering.

## NEW COMPANIES.

DAYTON, OHIO.—The Dayton Electrical Manufacturing Company has been formed. Capital stock, $20,000.

THE DRAWBAUGH ELECTRIC COMPANY has been incorporated under the laws of New Jersey, with a capital stock of $25,000.

THE ELECTRIC DISPLAY COMPANY has been formed under the laws of Maine by M. C. Milliken, of Portland; F. L. Milliken, of Hull; E. K. Milliken, and W. H. Gilman, of Wellington, Mass.

BALL ELECTRIC COMPANY has been formed at Yonkers, N. Y., with a capital stock of $300,000, by A. Sebring, E. M. Roberts, of Brooklyn, and E. S. Remsen, of Dobbs Ferry.

NATIONAL LIGHT SUPPLY COMPANY, of New York City, has been formed to make and deal in lighting supplies, with a capital stock of $1000, by A. Frankenheim, N. Rosenauer, New York, and S. Rubenstein, South Amboy, N. J.

J. ROBERTS PATENTS COMPANY has been formed with headquarters at 259 Washington Street, Jersey City, N. J., to make arc lamps, with a capital

stock of $20,000, by Joseph Roberts, August Dege, and Robert Carey, all of Jersey City.

INTERNATIONAL ELECTRIC CAR LIGHTING COMPANY, Philadelphia, has been formed for manufacturing and dealing in patent apparatus for lighting. Capital, $110,000. Incorporators, W. S. Dunlap, C. E. Lent, J. E. Lewis, T. R. Heller, E. A. Ryan, all of Philadelphia, Pa.

THE PROGRESSIVE LIGHTING COMPANY, which will manufacture incandescent lights, recorded articles of incorporation in New Jersey last week. The capital stock is $100,000, of which $1000 has been paid in by J. H. Nolan, of Newark, and Ernest Coe and Milton G. Butterfield, of Brooklyn.

ELECTRIC BOAT COMPANY, New York City, has been formed for the manufacture and sale of electrically propelled boats. Capital, $50,000. Incorporators: Isaac L. Rice, Hoffman Atkinson, Robert McA. Lloyd, E. B. Frost, John P. Holland, William Dulles, Jr., J. C. Chamberlain, all of New York City.

COTTON STATES ELECTRIC & MACHINE COMPANY has been organized at Columbia, S. C., and begins business this month in electrical supplies and general construction work. It will be glad to receive catalogues, price lists, etc. Mr. N. W. Girdwood is president, and Mr. R. R. Lawton manager.

THE SPRAGUE CAR APPLIANCE COMPANY has been formed under the laws of Maine for manufacturing car appliances. Capital, $500,000. Incorporators: C. F. Johnson, of Belmont; W. R. May, of Newton; A. L. Sprague, of Milton; W. O. Wiley, of Brookline; F. M. Rollins, of Neponset; M. C. Pettingill, of Danvers, Mass.

THE RAILWAYS & LIGHT COMPANY of America was incorporated at Trenton, N. J., on Sept. 29, with an authorized capital of $25,000,000, divided into shares of $50 each. The company is empowered to construct, equip, or acquire by lease or purchase, railroads operated by steam, electricity, compressed air, or other known power; also electric light, gas, heat and ice plants. The incorporators are Richard Darable, Clifford W. Perkins and William H. Brearley, all of Jersey City.

MEXICO.—The Mexican Construction & Development Company has filed articles of incorporation. The company has a capital of $100,000, and will develop silver and other mines, build and operate electric plants, telephone and telegraph lines and construct trolley lines as well as promote water rights. The incorporators are Thomas Watson, Cranford, N. J.; Eugene W. Small, New York City, and Frank D. Dillingham, of Summit, N. J. The principal office will be in Summit, Arthur W. Hicks being the company's agent.

## LEGAL.

STREET CAR BRAKES.—A despatch from Milwaukee states that the Westinghouse Air Brake Company has been denied a rehearing in the suit in which a verdict was rendered in favor of N. A. Christensen, of Milwaukee. This case involved the patent on an emergency device forming part of a street railway air brake. A company has been organized to exploit the Christensen invention.

WATTMETER LITIGATION.—On the 29th ultimo service was made in a suit brought by the Stanley Instrument Company against the General Electric Company for infringement of their patent No. 423,210, dated March 11, 1890, on alternating current wattmeters. The Stanley Instrument Company claim that this patent is fundamental and covers broadly induction wattmeters. This suit is brought before the court in Massachusetts. Messrs. Mitchell, Bartlett & Brownell, Times Building, New York, are the company's solicitors in the case.

## PERSONAL.

MR. A. E. NORSWICK, chief engineer of the new Mexican City trolley lines, has been in New York City placing orders for about $250,000 of material.

EDWARD E. McNAIR, who has been one of the efficient assistants in the Buffalo Public Library, has been appointed to a position in the office of the Buffalo Railway Company.

MR. A. J. CLARK, manager of the foreign department of the General Electric Company, goes from Europe to the Argentine Republic, where a large amount of new business is opening up.

MR. MARTIN J. INSULL, general manager of the General Incandescent Arc Light Company, has just returned home from a flying trip to England on important business. He has left again for the West.

BARTON—RUST.—A London despatch of October 7 states that Mr. Enos M. Barton, of Chicago, and Miss Mary, daughter of Henry A. Rust, also of Chicago, were married there in the Parish Church of Marylebone.

MR. EZRA F. SCATTERGOOD, instructor of mathematics, electricity and physics in Rutgers College, has accepted the chair of physics in the Atlanta School of Technology. He has just returned from a year's study in Europe, where he went on a fellowship from Yale.

MESSRS. WHITLEY & STREET, of Halifax, England, who have made an exhaustive and most painstaking study of electric lighting and railway conditions in this country and have made visits to all the noteworthy plants, left for home last Saturday by the Cunard steamer. On their report a great deal of new work may depend.

MR. W. N. WEGG was drowned a few days ago while hunting near Perham, Minn. He left Chicago three weeks ago for his annual hunting trip in Minnesota, and was joined at Antioch by L. J. Simons and his son. He was born in St. Thomas, Can., and was about thirty-four years old. He was well known in Chicago, being president of the Chicago Electric Company, 111 West Harrison Street. Besides his wife and brother, he is survived by one child and his mother. His brother is Mr. D. S. Wegg, president of the Railroad Supply Company, of Chicago.

COL. SAMUEL FINLEY BREEZE MORSE, who since 1894 has been general passenger and ticket agent for the Southern Pacific Company on its Atlantic system, has been appointed assistant general traffic manager of the Southern Pacific. With this appointment go those of passenger traffic manager of the Galveston, Harrisburg & San Antonio, the Texas & New Orleans and the Houston & Texas Central Railroad Company. Col. Morse's headquarters will be at Houston, Texas. He has been active in railroad business since 1874. When he was a lad of sixteen he became a clerk in the service of the Kentucky Central Railroad.

PROF. A. E. DOLBEAR proposes to dispute with Mr. Marconi the invention of the present system of wireless telegraphy that the latter is using so successfully. His patent of 1886 says: "My invention relates to establishing electric communication between two or more places without the use of a wire or other like conductor, and it consists in connecting the transmitting instrument with a ground the potentiality of which is considerably above the normal, and the receiving instrument with a ground the potentiality of which is considerably below the normal, the result being that an impulse from the transmitter sufficient to cause the receiver to give intelligible signals is transmitted through the earth without the need of any circuit, as has heretofore been deemed essential." Work was done on this plan.

## OBITUARY.

MR. J. M. PRICE.—James Martin Price, whose death is announced, was born in 1825, at West Chester, of Quaker parentage. After a preliminary education at Westtown School and at the then famous French school of Antoine Balmer, he graduated at the University of Pennsylvania, and for several years afterward was a teacher of classics. He had special talent as a linguist. He later became connected with the Provident Life & Trust Company's insurance department. For the last ten years Mr. Price was actively interested in devising railroad appliances, several of which he patented. He was at the time of his death manager of the Price Rail Joint Company.

# Trade and Industrial Notes.

WOOLSTON & BREW, 141 Broadway, have received an order for two Fisher engines, each of 40 hp, from Mr. J. M. Williams, of Salem, N. Y. They are to be used for electric lighting.

OIL FILTERS.—A neat brochure has just been issued by the Burt Manufacturing Company, Akron, Ohio, on the subject of its gravity oiling system. The features and advantages of these filters are pointed out, and a long list of users is given.

FORT WAYNE BULLETINS.—The Fort Wayne Electric Works have issued bulletins Nos. 1003 and 1004, devoted, the former to their high frequency alternators and the latter to the low frequency. Machines are shown and described of 140 cycles and 60 cycles.

A. A. McCREARY COMPANY.—The business of A. A. McCreary, manufacturer of electrical specialties, 136 Liberty Street, New York, has been taken over by the A. A. McCreary Company. Its operations will be greatly extended to meet the growing demands for the articles it makes.

ELECTRIC AIR HEATERS.—The American Electrical Heater Company, 197 River Street, Detroit, Mich., has issued a four-leaf folder giving dimensions and prices of its electric air heaters. These heaters are designed for any voltage up to 250. Heaters are also made for voltages from 250 to 500.

THE CENTRAL ELECTRIC COMPANY, Chicago, has taken the exclusive selling agency for the Duplex lamp guard and will supply the trade in any quantity. The Duplex is said to give entire satisfaction, both from protection given the lamp and the ease with which it is fastened to any standard socket.

THE FRANK MOSSBERG COMPANY, Attleboro, Mass., is erecting a factory with something over 20,000 square feet of floor space for the manufacture of bicycle sundries and stamping and sheet metal work of every description. The company will probably do considerable work in this line for the automobile industry.

THE SPRAGUE ELECTRIC COMPANY, New York, has issued a little book giving instructions for the proper installation of flexible metallic conduit. The process is illustrated. The booklet is gotten up in a substantial manner, the leaves being backed with linen, and it is a convenient size to carry in the vest pocket for ready reference

THE NEW PROCESS RAW HIDE COMPANY, Syracuse, N. Y., is patentee and sole manufacturer of new process raw hide, noiseless solid raw hide spur, bevel and friction gears, brushings, mashers, etc. The company has just issued a 106-page catalogue and price list of these goods, a copy of which will be mailed to any one interested.

THE WILLIAMS-ABBOTT ELECTRIC COMPANY, Cleveland, Ohio, is now selling its well known apparatus direct to telephone exchanges. It will pay exchange managers to look into the merits of these goods. The company claims that money can be saved by so doing. It has branched out extensively in all of its manufacturing departments and can take care of the largest orders.

LEATHER BELTING.—Messrs. Chas. A. Schieren & Co., New York, have just issued a new catalogue of their pure oak-tanned leather belting, lace leather, etc. Many half-tone cuts illustrate the method of making these belts, and give views of power stations where Schieren belts are in use. The catalogue is gotten up in a very artistic manner and contains much information of a practical character in the line of belts.

RUSHMORE PROJECTORS, manufactured by the Rushmore Dynamo Works, Jersey City, N. J., are largely used in marine service and quite a number are employed on land for lighting freight yards, ore docks, etc. A number are used in the Minnesota iron mines for lighting the open workings where frequent blasting prevents stringing of wires, the projectors being set up at a safe distance and the beams spread out as needed to cover the required area.

DIAMOND DIFFUSIVE REFLECTORS.—Messrs. Klemm & Co., 132 North Fifth Street, Philadelphia, Pa., have just issued a catalogue of electric light reflectors manufactured by them. This firm manufactures the American Reflector Company's patent Diamond Diffusive Reflectors for gas, oil and electric light. These reflectors are suitable for lighting churches, halls, theatres, stores, etc. The various designs of reflectors are illustrated and a price list is given.

DEWEY ILLUMINATIONS.—Special attention was called in the last issue of this journal to the very fine effects in special illumination produced on the Staats Zeitung Building. The brilliancy of the lighting was a matter of universal comment. It appears that the lamps for this fine piece of work were furnished by the Orient Electrical Company, of Youngstown, Ohio. The illuminations, as shown by the cut, covered a large part of the entire front and were seen nightly by immense throngs of people, who were outspoken in their admiration.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., are erecting in the village of Baldwinsville, N. Y., between the towns of Van Buren and Lysander, a plate girder bridge consisting of three spans of 85 feet each. The bridge has a roadway 30 feet wide and two sidewalks 7 feet wide. The structure is a very substantial one throughout; the flooring is of buckle plate carrying concrete roadway. The bridge is designed to carry a double track electric street railway line, besides the ordinary city traffic.

MAKING RECORDS.—With this title the Joseph Dixon Crucible Company, Jersey City, N. J., has issued a cleverly written and illustrated pamphlet telling, "How Dixon's Flake Graphite Helps." A practical book from start to finish, it states a few facts bearing on the use of graphite for lubricating purposes, and then supports them by quoting the words of half a hundred practical men who know from experience, not theory, what they are talking about. Scientific evidence, however, is not neglected, one section being devoted to "Scientific Bits."

GENERAL INCANDESCENT ARC LIGHT COMPANY has recently issued several bulletins and pamphlets, including a tasty price list of Tailleur Underground Apparatus, of which they are exclusive manufacturers. We have also received a copy of circular descriptive of the "G. I." arc lamp hanger reel, recently illustrated in our columns. This device has already attracted considerable attention. A neat folder which has just made its appearance summarizes the products of the company, which cover a surprisingly large range. New bulletins on arc lamps and on switches are announced as in preparation.

A BIG FIRE.—A very destructive fire occurred a year ago in the town of Park City, Utah. Practically the entire business portion was destroyed and much loss resulted. An incident of the fire, however, is recalled by a letter from the secretary of the Silver King Mining Company, of Park City. In this he states that their offices were on the second floor of a building that was burned. Among their office effects were two large filing cabinets or cases. One of these, being a solid case, bulky and hard to handle, was destroyed. The other, a Globe-Wernicke "Elastic" cabinet, made up of units or sections, was carried out unit by unit without disturbing the contents, and saved in perfect condition. This cabinet is made by the Globe-Wernicke Company, of Cincinnati, New York, Chicago and Boston.

STURTEVANT LITERATURE.—The high character and educational value of the literature issued by the B. F. Sturtevant Company, of Boston, is well evidenced by the following extract from a letter recently received by them: "I am much indebted to you for a gift of a copy of your Treatise on Mechanical Draft. It will be of much aid to me in the preparation of my handbook. Previously when I have needed to consult it I have made a trip of 25 miles to Syracuse to consult the copy in the Syracuse Public Library." This book is an authoritative work of some 400 pages, and deals not only with the problem of mechanical draft, but with all of the important factors concerned in steam boiler practice. Although originally issued for free distribution, the constantly increasing demand for this work has necessitated placing a nominal price of $1.50 upon it. The second revised edition has just been issued.

J. B. COLT & CO.—Judge Giegerich, of the New York Supreme Court, on Oct. 3 appointed Wilbur Larremore receiver for J. B. Colt & Co., manufacturers of magic lanterns and scientific apparatus, at 3 to 7 West Twenty-ninth Street, with salesrooms in Chicago, San Francisco and Atlanta, Ga., on the application of the directors of the company, Charles Goodyear, president, James B. Colt, vice-president, and Walter Goodyear, treasurer, in proceedings for the voluntary dissolution of the corporation. The receiver's bond was fixed at $40,000. It was stated that the corporation had been unable to procure additional capital. The liabilities are about $90,000, of which $42,497 are bills payable, $17,000 accounts payable and the balance principally for loans. It was stated that while the assets are nominally worth more than enough to pay the debts of the corporation, it is impossible to estimate their value if suddenly converted into cash or levied upon by creditors. The company has of late gone very heavily into the manufacture of acetylene gas apparatus.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, Mo., have demonstrated in a very practical and conclusive manner that an arc lamp and apparatus department is not only a necessary but a paying adjunct, and the electrical supply house. They are agents for the Eddy direct current, and the Warren alternating current, apparatus, and report they have recently closed a number of very satisfactory contracts. Wherever they have installed this apparatus it has been more than satisfactory. They are also agents for the celebrated Adams-Bagnall enclosed arc lamps. They report that this department is crowded with orders, and that in very few instances where they have had these lamps in competitive tests have they failed to come back without the order. The general supply business has been exceedingly good. Their policy of carrying a complete line, and ability to make prompt and satisfactory shipments from stock, has earned for them a very enviable reputation. They have got out a complete and up-to-date line of catalogues, covering everything pertaining to electrical apparatus, and supplies of every description. They mail these on application.

THE ARNOLD ELECTRIC POWER STATION COMPANY, of Chicago, was organized in 1896 to make and sell the parts peculiar to the "Arnold System" of power station construction, and acting in this capacity it has supplied a number of plants with magnetic clutches, shafts, quills, box stands and couplings. Among these plants may be mentioned the Fort Dodge Light & Power Company, Fort Dodge, Iowa; Chicago Board of Trade; Englewood & Chicago Electric Railway; Land Title & Trust Building, Philadelphia; University of Michigan, Ann Arbor, and W. B. Conkey Company, Hammond, Ind. Through natural development this company has gradually broadened the scope of its work until it is now in position to make a proposition for furnishing and erecting in place entire electrical properties, and it already has an enviable record along this line. The entire power plant and building of the Imperial Electric Light, Heat & Power Company, at St. Louis, Mo., was constructed by the Arnold Company. The Arnold Company was also given the contract for the complete light, heat and power plant erected in connection with the new railroad shops of the Chicago Great Western Railroad at Colwain, Iowa. Another notable installation recently completed is the isolated plant for the Garrett Building, Chicago, which is remarkable for the small amount of space occupied. It is easy to predict that many railways will be built upon the plan of the Chicago & Milwaukee Electric Railroad, another Arnold contract, and that the Arnold magnetic clutch and the "Arnold System" of power station construction will become well known features in power station work. The advent into general electrical contracting work of the Arnold Power Station Company, prepared as it is with an organization capable of handling the largest contracts and willing to guarantee the operation and the economy of a completed plant or installation, is a development which promises to bring about new methods in building extensive electric properties.

# Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED OCT. 3, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

633,982. PUNCHING REGISTER; C. Berst, New Albany, Ind. App. filed Dec. 6, 1898. The paper feeding devices are actuated by a spring which is automatically rewound by the operation of the main gear train.

634,023. ELECTRIC SIGNAL FOR RAILWAYS; T. H. Patenall, Easton, Pa. App. filed Jan. 17, 1899. A semaphore arm is raised and lowered through worm gearing driven by an electric motor.

634,057. ELECTRIC SWITCH; W. Ely, Providence, R. I. App. filed Feb. 4, 1898. Structural details of a quick acting switch.

634,085. ELECTRIC ARC LAMP; A. Hamacek, Sturgeon Bay, Wis. App. filed May 12, 1899. This invention, which consists principally in the details of construction, is directed to the provision of a lamp which may by slight changes in wiring be used on a constant potential direct or alternating current circuit. Noiseless feed is also an object when operating on alternating circuits.

634,095. ELECTRIC ANNUNCIATOR; C. E. Scribner, Chicago, Ill. App. filed Feb. 4, 1892. The main feature of the invention consists in making the drop or indicating piece of the annunciator of soft iron and combining therewith a curtain or shield which is thrown up to disclose the face of the drop by the slight movement of the drop itself when released. This apron or shield when thus thrown up serves also as a target to readily catch the eye of the operator, so that her attention may be at once attracted to the particular annunciator that has been operated. When the operator plugs in the line of a subscriber who has thus operated his individual annunciator the drop is restored, since current is automatically sent through an extra coil.

634,118. DANGER SIGNAL SYSTEM; W. Mayes, Omaha, Neb. App. filed Sept. 6, 1898. On a single track railway circuits are arranged so that when a train enters a block the circuit will be put into such condition that when another train enters the same block from the opposite direction another switch will be operated and the danger signal thrown out.

634,157. ELECTRIC ARC LAMP; J. M. Willard, Decatur, Ill. App. filed July 11, 1898. The invention here relates to the details of construction, the object being to produce a steady light, slow consumption of carbons and means for automatically cutting out individual lamps at a predetermined time and preventing their being thrown in again by the use of the ordinary switch.

634,169. FLEXIBLE ELECTRICAL CONDUIT OR TUBE; C. T. Greenfield, New York. App. filed July 17, 1899. The tube is formed of spirally wound strips having their edges serrated to interlock with each other.

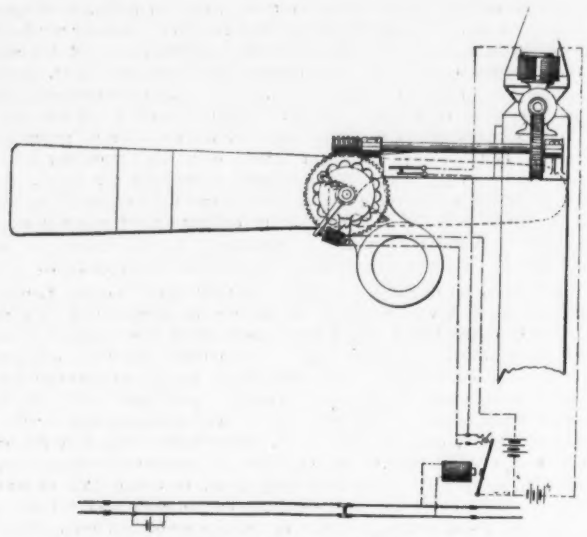
634,187. RAILWAY SIGNAL; J. Sargent, Rochester, N. Y. App. filed April 22, 1899. The semaphore is moved by a motor and when located is locked by a latching device under the control of an electromagnet.

634,198. METHOD OF AND MEANS FOR PREVENTING ELECTRIC SPARKING; C. L. Buckingham and E. Germann, New York. App. filed June 26, 1896. (See Current News and Notes.)

634,226. ELECTRIC SWITCH OR SIGNAL APPARATUS; F. Andrews, Chicago, Ill. App. filed Sept. 3, 1898. The switch is for elevators. Switch-

ing arms are used, to be struck and moved by inclined surfaces placed in the shaft, such movement affecting the signal circuit.

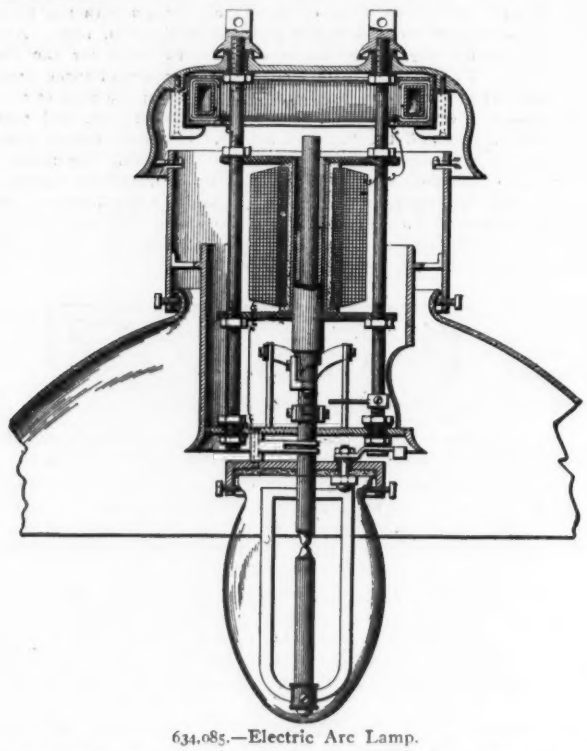
634,227. ELECTRIC SIGNALING DEVICE FOR ELEVATORS; C. G. Armstrong, Chicago, Ill. App. filed May 6, 1897. This signal is arranged to be delivered to the operator on the car only when he is approaching a floor from which it is sent. The device comprises a plurality of electrically operated switches corresponding with the floors of the building, individual magnets for actuating said switches, electric circuits wherein said magnets are placed, circuit closers at the individual floors for controlling passage of current through said magnets, individual magnets for operating said switches to restore the same to normal condition, a commutator operated by the elevator mechanism, and having a plurality of contact plates corresponding with the floors and severally in circuit with said switches and an electric signal on the car in circuit with said commutator.



634,023.—Electric Signal for Railways.

634,229. ELECTRIC SIGNALING APPARATUS FOR ELEVATORS; S. D. Collett, New York. App. filed Sept. 3, 1898. The car is provided with two sets of signals corresponding in number and arrangement with the several floors of the building. One set serves to indicate where it is desired the car should stop during its downward movement and the other indicated the stopping points for the upward movement.

634,231. ELECTRIC BELT; L. A. Dixon, Marshall, Mich. App. filed June 6, 1899. (See Current News and Notes.)



634,085.—Electric Arc Lamp.

634,258. SYSTEM FOR POWER TRANSMISSION FOR ELECTRIC TRACTION; E. Bede, Brussels, Belgium. App. filed Sept. 23, 1897. (See Current News and Notes.)

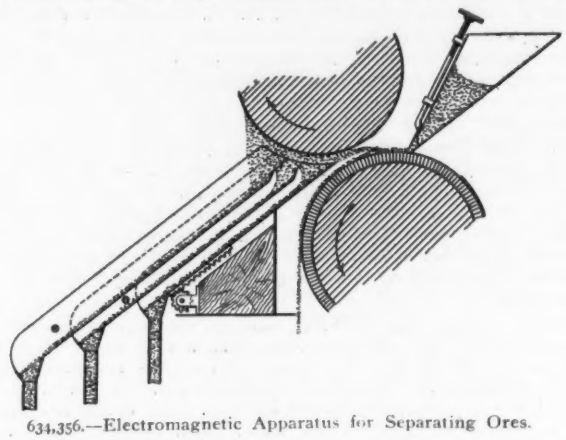
634,286. ELECTRIC LIGHTING SYSTEM FOR CARS; J. L. Crevelin, New York. App. filed July 15, 1899. The dynamo is driven from the car axle. The field of the dynamo is strongly energized by current from a storage battery, and the invention comprehends means whereby the connection between the energizing coils and the battery is made when the armature approaches a certain speed, and broken when the speed falls below a certain point, thus preventing waste of current through the energizing coils while the generator is at rest.

634,314. ELECTRIC ARC LAMP; C. Tepel, Bennet, Pa. App. filed Nov. 18, 1898. The invention consists of a suitable supported solenoid having its cores attached to levers which are connected by insulated couplings to the upper curved ends of levers carrying the carbon holders. The carbon rods are horizontally disposed with their points in an airtight globe.

634,356. ELECTROMAGNETIC APPARATUS FOR SEPARATING ORES; E. Kreuser, Mechernich, Germany. App. filed Feb. 28, 1899. The magnets are of such shape and arrangement that the magnetic field is large and of varying strength. The crushed ore, which is of varying magnetic susceptibilities, passes through the field and falls into different chutes so arranged that all of the ore is separated and finds an outlet through one or the other of the chutes.

634,381. JUNCTION BOX FOR MANHOLES; J. W. Turner, New Orleans. App. filed July 17, 1899. The junction box is supported in the upper portion of the manhole and has wire connections accessible from the interior of the manhole; it is also provided with a cover allowing access to its interior from the exterior of the manhole.

634,388. RAILWAY SIGNAL; W. S. Boult, London, England. App. filed Dec. 30, 1897. The essential feature of the invention is the employment of a magnet and apparatus which collects and focuses the lines of force from the magnet, thereby causing movement of a needle, such movement being utilized to give a signal by closing an electric circuit.



634,356.—Electromagnetic Apparatus for Separating Ores.

634,403. ELECTRICAL APPARATUS FOR EXHIBITING AND CHANGING ADVERTISEMENTS, SIGNS OR THE LIKE; A. D. Douglass, London, England. App. filed April 11, 1899. Letters are traced in a sign by electric lamps, one letter superposed upon the other, the lamps of one letter being used for another wherever the lines coincide. A suitable switch is arranged to display the letters successively.

## GERMAN PATENTS, ISSUED SEPT. 20, 1899.

[In charge of Dr. Ralph Julian Sachers, 120 Liberty Street, New York.]

104,216. ARC-LAMP WITH SPRING MOTOR, Societé les fils d'Adolph Mongin, Paris. Filed April 23, 1898. The lamp operates in any position. A spring motor controlled by an automatically operating electro-magnet in shunt to the main circuit, acts upon an endless cord or chain connecting the carbon-holders.

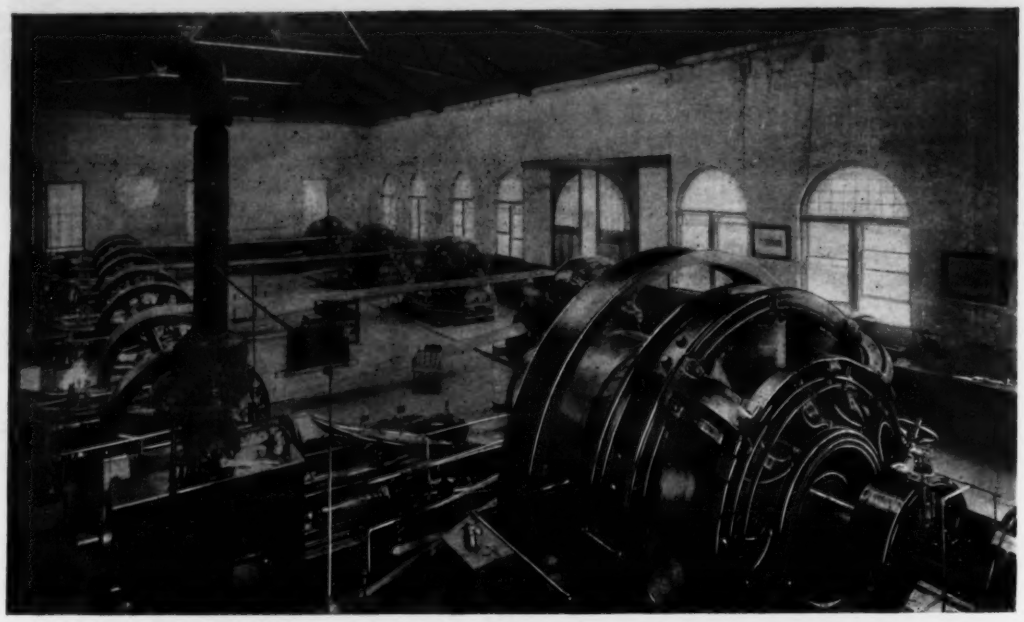
104,265. AXLE-BEARING FOR ELECTRIC METERS, Sydney Evershed and Evershed & Vignoles, Limited, London. Filed Feb. 15, 1898. A single magnetic pole is arranged above the upper bearing of the vertical shaft of an electro-meter whereby the magnetic lines of force become concentrated near the geometrical axis of the shaft.

104,301. ROTARY TRANSFORMERS; Societé Anonyme pour la Transmission de la Force par L'Electricité, Paris. Filed Dec. 7, 1898. The transformer consists of an asynchronous motor and a direct current generator. The induced current circuit of the motor and the armature of the generator are divided in sections, which, parallel to the sections of the generator armature, are connected with the commutator-bars in such a way that the shunted sections of the two armatures are symmetrical with regard to a plane, through the axis of the machine system. The transformer consequently has a number of revolutions equal to one-half of the synchronous motor having the same number of poles.

104,342. DEVICE FOR MEASURING THE AVERAGE TENSION IN ELECTRIC CIRCUITS; Siemens & Halske, Berlin. Filed Nov. 3, 1898. A resistance consisting of a suitable number of sections is placed in front of the voltmeter, and brings the resistance R-n of the test-wires employed always to the same normal R.

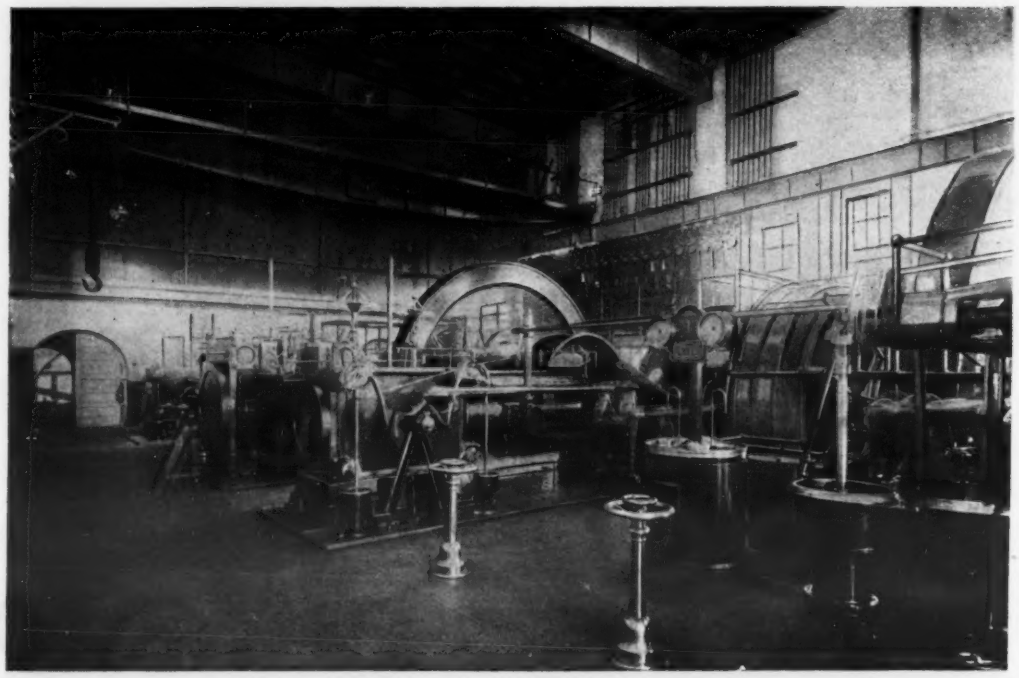
104,421. IMPROVEMENT ON THE PRINTING TELEGRAPH OF PATENT 85,087; Bernhard Hoffmann, Paris. Filed Jan. 27, 1897. An inner sliding ring located on the shaft of the type-wheel carries on isolated metal piece, which closes the circuit of the local battery and the magnet of the ratchet-wheel. As soon as a brush sliding on said ring reaches the isolated metal piece, the local circuit for the electro-magnet of the ratchet-wheel will be interrupted, the wheel will stop and the apparatus be kept in its starting position until the key for reversing the currents is released.

104,473. METHOD OF PRODUCING AND DISTRIBUTING COMBINED ALTERNATING AND DIRECT CURRENTS; Helios Company, Cologne. Filed July 19, 1898. An alternating current generator and storage battery are placed in relation to each other on a three-wire circuit, so that the sums of their e. m. f. produce an undulatory current between the two leads of the circuit; an alternating current may be taken between two other leads, and a direct current between a third pair of leads.

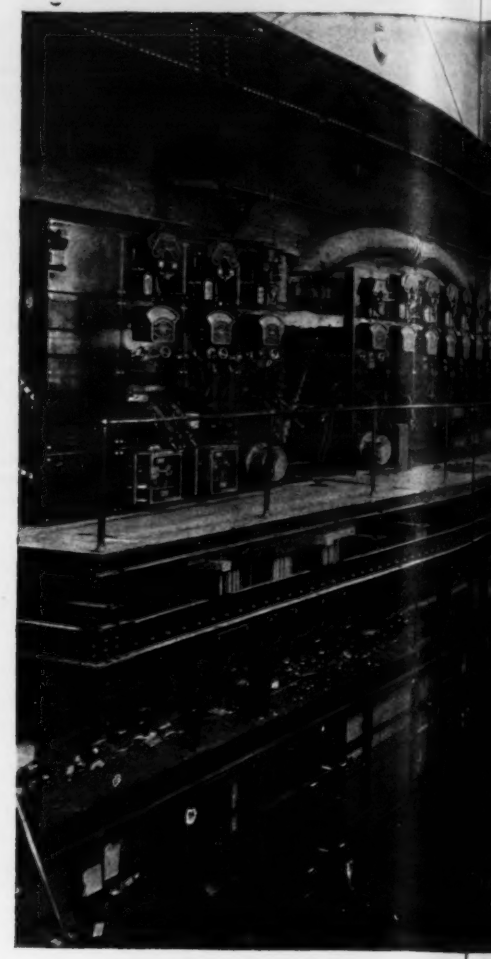


POWER PLANT, CALUMET RAILWAY, CHICAGO.

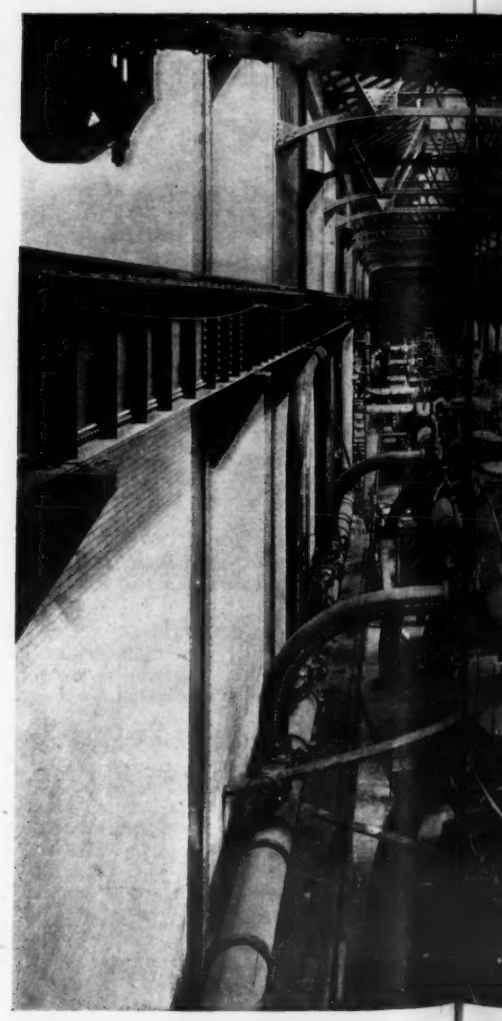
CHIC. CONSOLIDATED TRACTION CO., CAL. AVE. AND ROSCOE ST.



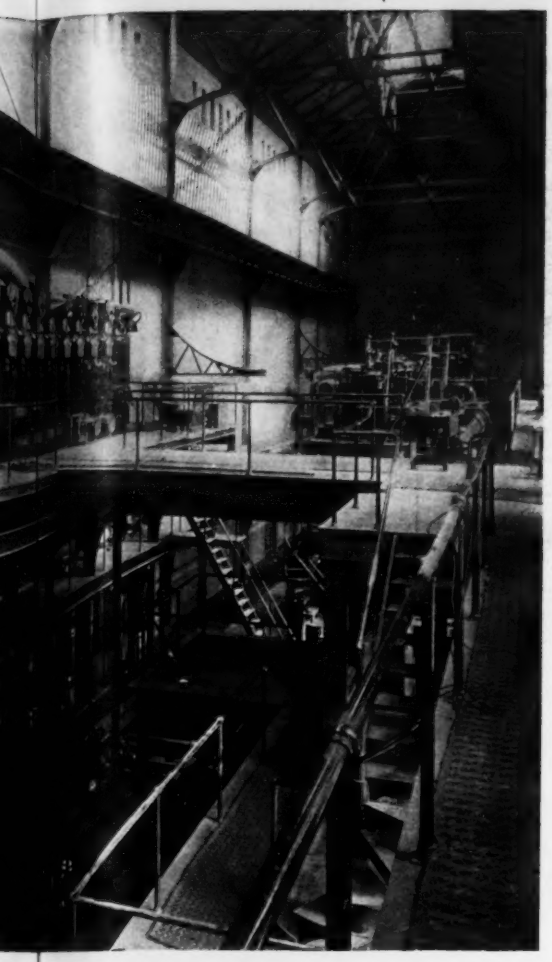
CHIC. CONSOL. TRACTION CO., LAKE ST. AND HARVEY AVE.



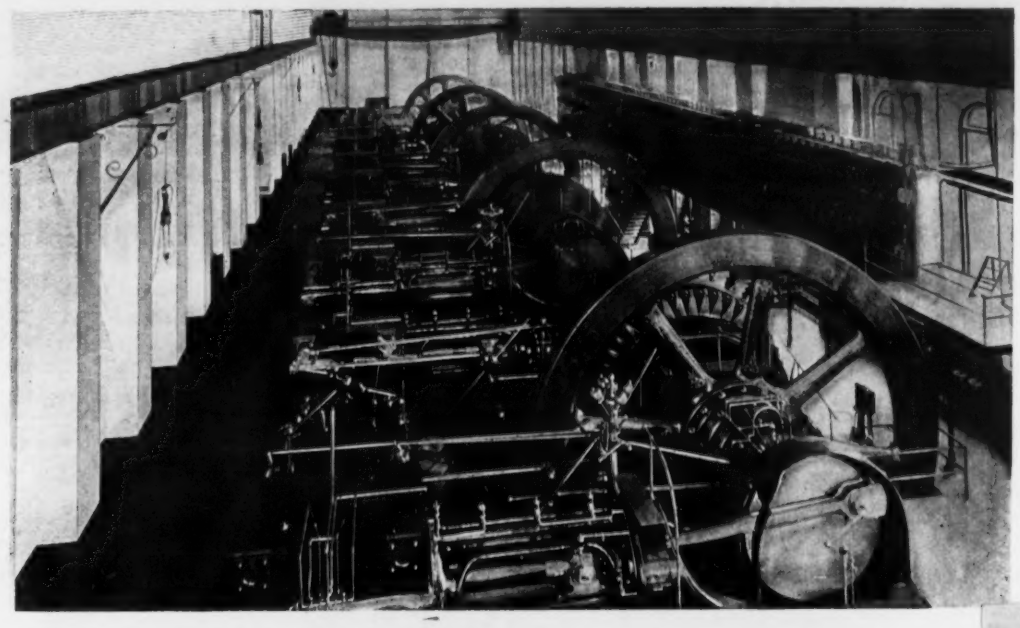
SWITCHBOARD POWER PLANT, MET



POWER PLANT, METROPOLITAN



ANT, METROPOLITAN ELEVATED, CHICAGO.



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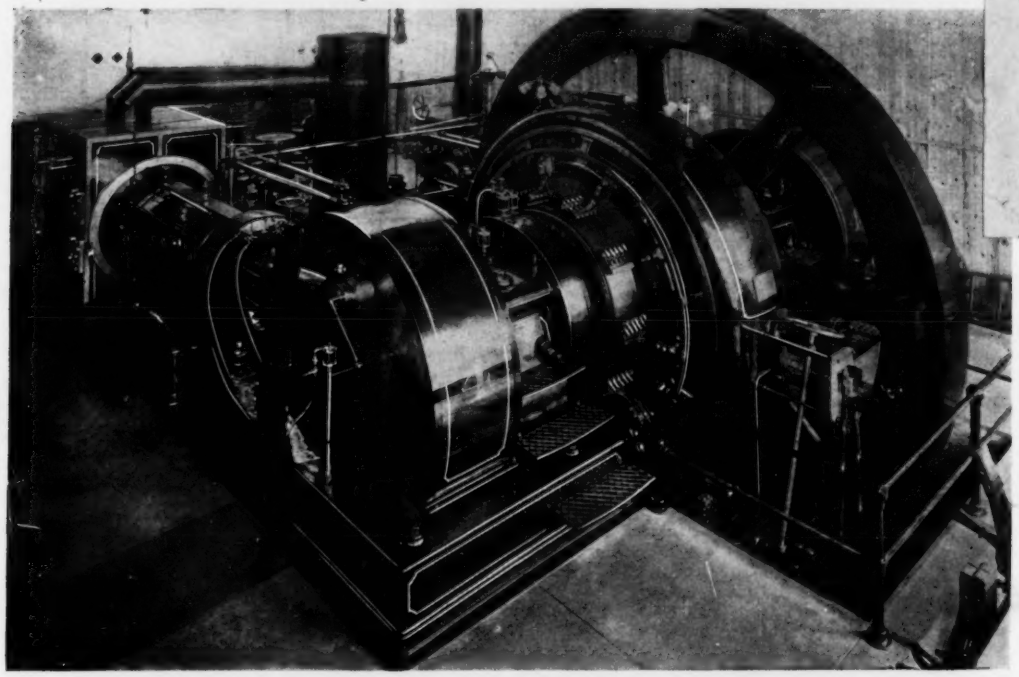
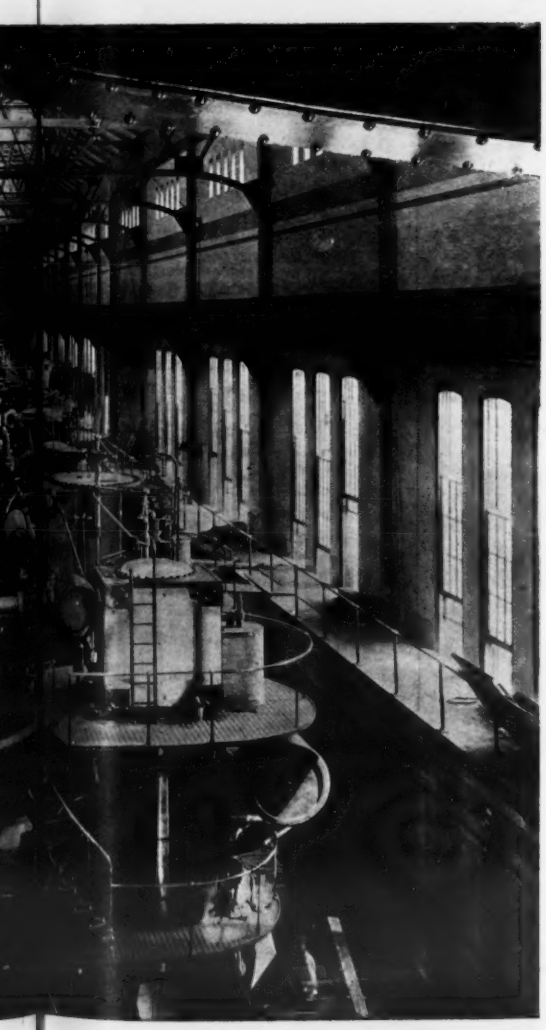
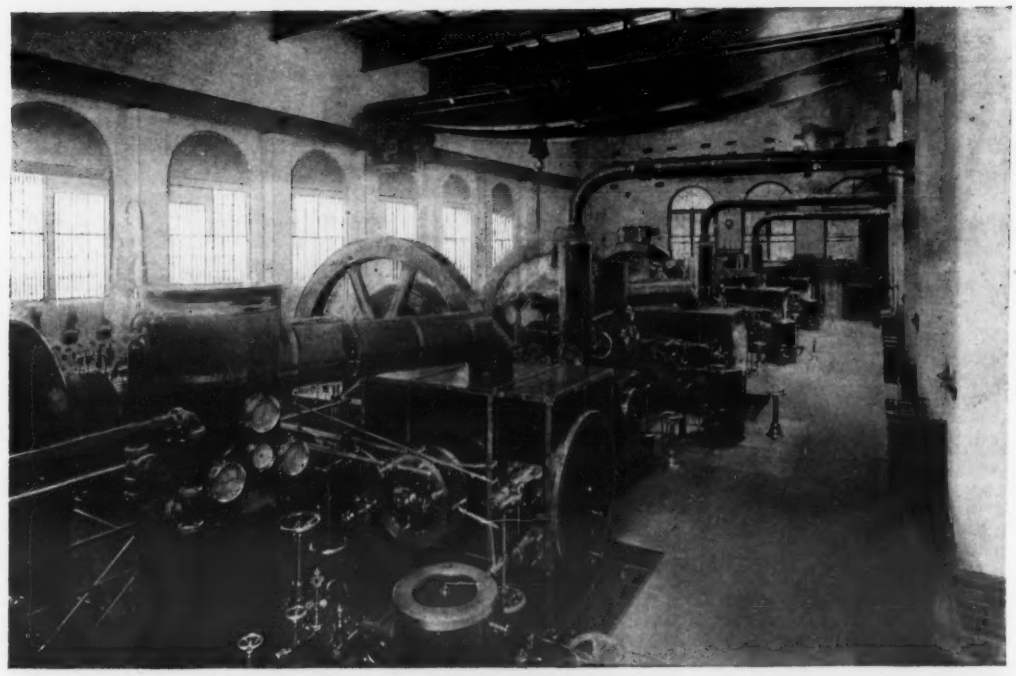


UNIT, CHICAGO SOUTH SIDE ELEVATED.



METROPOLITAN ELEVATED, CHICAGO.



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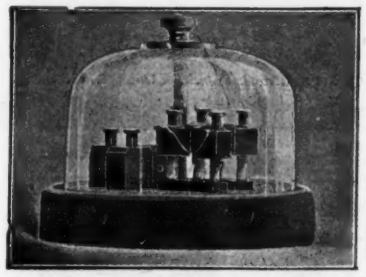

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WANTED—Electrician to go to the southwestern part of Virginia. Must be competent and able to do general repair work on power and light machines, also to repair and keep in order mining machines, electric motors—rewinding armatures and transformers. Send recommendations with application. Good wages paid. Address "F. D. F.," care Electrical World and Engineer, New York.


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POSITION WANTED—By young man as manager, superintendent or electrician of station; good references; 10 years' practical experience; have made a study of central station engineering, economy and operation; competent to design, construct and operate complete plant; a permanent position desired. Address "PRACTICE," care Electrical World and Engineer, New York.

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POSITION WANTED—Electrical engineer just returned from West Indies wants position with consulting engineer, electric power or traction company or manufacturing concern. Highest technical training, coupled with practical experience in factory and construction. Unquestioned references. Familiar with French, German and Spanish. Willing to go abroad again. Address "G. S. F.," care Electrical World and Engineer, New York.

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POSITION WANTED—By experienced electrician, who is a machinist; not afraid of work; understanding engines, boilers and dynamos; competent in the operation and construction of a plant; both mechanically and electrically experienced in electric crane work; references given. Address "M. P.," care Electrical World and Engineer, New York.

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42 " Lundell, slow speed, self-oiler.
60 " Wenstrom comp., slow speed.
65 " Kester, M.P.
70 " Ft. Wayne, Jenney.
70 " Central Electric.
75 " Royal.
80 " T.-H., self-oiler.
100 " Eastern, self-oiler.
120 " Detroit Elec. Wks., self-oiler.
150 " Eddy, self-oiler, ring type.
150 " Mather, ring type.
160 " Jenney, compound, self-oiler.
180 " Westinghouse, s. o., letter type.
180 " Detroit Elec. Wks., self-oiler.
200 " Electro-Dynamic.
250 " T.-H., type E. I., compound.
250 " Commercial, self-oiler, comp.
250 " Jenney, self-oiler, compound.
270 " Triumph, M.P., self-oiler.
300 " Royal, compound.
320 " Eickmeyer.
340 " Eddy, self-oiler, compound.
350 " National, brand new, self-oiler.
350 " Jenney, s. o., comp., new arm't.
450 " T.-H., type H. I., compound.
450 " Triumph, self-oiler, compound.
450 " Edison, 25 K. W., self-oiler.
450 " Wood, M.P., self-oiler, comp.
480 " Brush, compound.
500 " United States.
500 " Kester, self-oiler, compound.
540 " Edison, 30 K. W., oil cup.
540 " Edison, 30 K. W., self-oiler.
600 " Eickmeyer.
800 " Rockford, self-oiler, new arm't.
800 " Mather, M.P., comp., self-oiler.
800 " Edison, 45 K. W., s. o., comp.
1350-light Waddell-Enz, 80 K. W., M.P., for direct connection.

### 220-VOLT GENERATORS.

8½ K. W. Eddy, self-oiler.
12 " Westinghouse, letter type, s. o.
12 " Eddy, self-oiler.
12 " Edison, self-oiler.
15 " Edison, self-oiler.
22 " C. & C., self-oiler.
20 " Commercial, M.P., self-oiler.
25 " Edison, self-oiler.
30 " Crocker-Wheeler, s. o., M.P.
40 " Ft. Wayne Jenney.
40 " T.-H., D40.
40 " Westinghouse, Manchester type, self-oiler, slow speed.
45 " Edison, self-oiler, compound, newly rewound.

### 500-VOLT GENERATORS.

17 K W. Card, self-oiler.
20 " T.-H., D20, self-oiler.
25 " Rockford, self-oiler, new, comp., Manchester type.
25 " Edison, self-oiler.
30 " Jenney, self-oiler.
30 " Eddy, engine type, M.P., direct-connected to 50 H. P. Ideal Engine.
45 " Edison, compound, self-oilers.
60 " Sprague, new armature, s. o.
75 " Westinghouse, M.P., s. o.
100 " Commercial, s. o., compound, M.P., new armature.
200 " Triumph, M.P., new, self-oiler, compound, 6 pole.

### ALTERNATING GENERATORS.

350-light Thomson-Houston, self-oiler, composite wound, with exciter.
500-light Bain, 30 K. W., self-oiler, new arm't, 15,000 v., with exciter.
600 " Thomson-Houston, A6, 15,000 alt., 1100 v., complete, with exciter.
600 " Thomson-Houston, 30 K. W., two-phase, 1100 volts, 15,000 alternations, complete, with exciter.
600 " General Electric, A30, s. o., latest type, toothed armature, comp., wound, 15,000 alternations, 1100 volts, complete, with exciter.
650 " Standard, self-oiler, inductor type, 1100 volts, 15,000 alternations, complete, with exciter.
650 " Thomson-Houston, A35, composite wound, 15,000 alt., 1100 v., complete, with exciters.
650 " Thomson-Houston, A35, self-oiler, 15,000 alt., composite wound, 1100 volts, with exciter.
750 " Westinghouse, 37½ K. W., 1100 volts, 16,000 alternations.
750 " Westinghouse, 1100 volts, 16,000 alt., complete, with exciter.
750 " Westinghouse, 2000 volts, 16,000 alt., complete, with exciter, new armature.
750 " Westinghouse, 1100 volts, 16,000 alt., self-oiler, with exciter.
750 " Westinghouse, 2000 volts, 16,000 alt., self-oiler, with exciter.
750 " National, 1100 volts, 16,000 alt., with exciter.
750 " National, 1100 volts, 16,000 alt., self-oiler, with exciter.
900 " Royal, 45 K. W., 1100 or 2200 v., rotating field, 16,000 alt., slow speed, composite wound, complete, with exciter.
900-light Westinghouse, self-oiler, 45 K. W., latest type, toothed armature, 1100 volts, 16,000 alt., composite wound, complete, with exciter.
1000 " National, 1100 volts, 16,000 alt., new armature, with exciter.
1000 " Ft. Wayne Wood, 50 K. W., self-oiler, 1100 volts, 16,800 alternations, latest type, toothed armature, composite wound, complete, with exciter.
Marble switchboards and instruments extra.
1200 " Westinghouse, 1100 volts, 16,000 alternations, 60 K. W., latest type, toothed armature, composite windings, s. o., complete, with exciters.
1300 " Westinghouse, 1100 volts, 16,000 alternations, complete, with exciter.
1300 " Thomson-Houston, A70, 1100 v., 15,000 alternations, self-oiler, composite wound, complete, with exciter.
1300 " Thomson-Houston, A70, 2000 v., 15,000 alternations, self-oiler, composite wound, complete, with exciter.
3000 " Westinghouse, 150 K. W., self-oiler, 1100 volts, 16,000 alt., with slotted armature, compensating field, complete, with exciter.
6000 " Westinghouse, 300 K. W., 1100 v., 16,000 alt., latest type, toothed armature, composite wound, self-oiler, out-board bearings, complete, with exciter.

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of electrical apparatus may be properly defined as follows: old types that have been put out of commission—but whose days of usefulness are extended by copious "fixing up"—and the modern types that are supplanted in cases where an increase in the capacity of a plant becomes necessary. This latter is the class of machinery which we handle—and this only. Hence it is that our stock embraces all the best makes and most modern types, such as General Electric, Westinghouse etc.

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2, 240 KW., 2-PHASE STANLEY, 380 R. P. M., WITH ENGINES *DIRECT CONNECTED*.
2, 300 Kw. Westinghouse single-phase, iron clad toothed armature.
2, 150 Kw. Westinghouse single-pnase, iron clad toothed armature.
1, 120 Kw. Westinghouse single-phase, 2000 volts, iron clad toothed armature.
2, 120 Kw. Westinghouse, 1000 volts, iron clad toothed armature, single-phase.
2, 75 Kw. Westinghouse two-phase, 2000 volts, low frequency.
1, 60 Kw. Westinghouse two-phase, 2000 volts, low frequency.
1, 60 Kw. Westinghouse single-phase, 1000 volts, low frequency, iron clad toothed armature.
1, 45 Kw. Westinghouse single-phase, 1000 volt, low frequency, iron clad toothed armature.
1, 30 Kw. Westinghouse single-phase, 1000 volt, iron clad toothed armature.
1, 240 Kw. single-phase General Electric, 1000 volts, high frequency, toothed armature.
2, 120 Kw., 2000 volts, General Electric toothed armature.
2, 120 Kw., 1000 volt, General Electric, toothed armature.
2, 90 Kw. General Electric, 1000 volts, toothed armature.
2, A-70 T.-H., 1000 volts.
2, A-60 General Electric, 1000 volts, toothed armature.
2, A-35 T.-H., 1000 volts.
2, A-30 General Electric, 1000 volts, toothed armature.
2, 180 Kw. Stanley, two-phase, 2000 or 1000 volts.
2, 150 Kw. Stanley, two-phase, 2000 or 1000 volts.
2, 60 Kw. Stanley, two-phase, 2000 or 1000 volts.
2, 150 Kw. Fort Wayne, 2000 or 1000 volts, single-phase, latest type.

### DIRECT CURRENT DYNAMOS.

(110 Volts.)

100 Kw. Edison bi-polar.
60 Kw. Edison bi-polar.
45 Kw. Edison bi-polar.
30 Kw. Edison bi-polar.
25 Kw. Edison bi-polar.
20 Edison bi-polar.
15 Kw. Edison bi-polar.
10 Kw. Edison bi-polar.
7½ h.p. Eddy.
2, 12 Kw. Edison, bi-polar, compound wound.
1, 37 Kw. Westinghouse, compound wound.
2, 75 Kw. M.P. Westinghouse, modern speed.
2, 150 Kw. Edison bi-polar.
1, 12 Kw. Eddy.
1, 11¼ Kw. multipolar, slow speed, Westinghouse.
1, 15 Kw. multipolar General Electric.

### DIRECT CURRENT MOTOR GENERATORS.

(220 Volts.)

100 h.p. Westinghouse M.P.
80 Kw. Siemens-Halske M.P.
25 h.p. C & C.
15 h.p. General Electric M.P.
2, 4½ Kw. General Electric M.P.
1, 10 h.p. Westinghouse M.P.
2, 10 h.p. Eddy M.P.
1, 5 h.p. Eddy.
Besides other machines as small as ½ h.p.

### DIRECT CURRENT MOTORS.

(500 Volts.)

1, 50 h.p. Thomson-Houston, D-50.
1, 45 Kw. Edison.
1, 40 h.p. Westinghouse multipolar, 950 r.p.m.
1, 40 h.p. Crocker Wheeler.
1, 30 h.p. Westinghouse, multipolar, moderate speed.
1, 30 Kw. Belknap.
1, 25 h.p. Crocker Wheeler multipolar.
1, 15 h.p. Keystone, slow speed, 600 r.p.m.
1, 15 h.p. General Electric, multipolar, moderate speed.
1, 12 Kw. Edison.
2, 10 h.p. General Electric multipolar, moderate speed.
1, 10 h.p. Mather.
1, 10 h.p. Eddy.

### DIRECT CONNECTED UNITS.

M.P., 10-500-125, General Electric Railway Generator and Vert. Compound Lake Erie Engine.
50 Kw. Crescent M.P. 110 volt Generator, direct connected to Fischer high speed Auto. engine.
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20-light 1200 C. P. Excelsior.
20 " 2000 " Western Electric.
25 " 2000 " T.-H., type L2, ring armature.
30 " 2000 " Western Electric.
30 " 2000 " Brush, No. 7.
35 " 2000 " T.-H., LD2.
35 " 2000 " T.-H., LD2, ring arm.
40 " 2000 " Wood, No. 7.
40 " 2000 " Western Electric.
45 " 1200 " T.-H., M12.
45 " 1200 " T.-H., ring armature.
45 " 1200 " Brush, No. 7.
50 " 2000 " Excelsior, brand new, latest type.
50 " 1200 " Standard.
50 " 2000 " Standard, new armature and commutator.
50 " 1200 " T.-H., LD12.
50 " 1200 " T.-H., LD12, ring armature, oil cup.
50 " 1200 " T.-H., LD12, new ring armature, s. o.
60 " 2000 " Wood, No. 8, Ft. Wayne
65 " 2000 " Brush.
75 " 1200 " Wood, No. 8, Ft. Wayne
100 " 2000 " Western Electric, new multipolar type.
125 " 1200 " Excelsior, latest type.
125 " 2000 " Ft. Wayne Wood, No. 10, brand new.

### 110-VOLT MOTORS.

⅛ H. P. C & C.
⅛ " Eck.
¼ " C & C.
1 " T.-H., self-oiler.
2 " Jones.
2 " Onondaga, self-oiler.
3 " Jenney, self-oiler.
3 " Eddy, self-oiler.
3 " Lundell, slow speed, self-oiler.
4 " Wenstrom, slow sp., Iron-clad.
4 " Kester, M.P.
5 " T.-H., self-oilers.
5 H. P. Ft. Wayne Jenney.
5 " Royal.
5 " Central Electric.
7½ " Eastern, self-oiler.
7½ " Detroit Electric Works, s. o.
10 " Mather, ring type.
10 " Eddy, ring type, self-oiler.
10 " Jenney, self-oiler.
12 " Detroit Electric Works, s. o.
15 " Electro-Dynamic.
15 " Westinghouse, letter type, s. o.
15 " Edison, 12 K. W., self-oiler.
18 " Jenney, self-oiler.
18 " Commercial, self-oiler.
18 " Triumph, M.P., self-oiler.
20 " Royal.
20 " Eickmeyer.
24 " Eddy, self-oiler.
25 " Jenney, self-oiler, new arm't.
30 " Triumph, self-oiler.
30 " Ft. Wayne Wood, M.P., s. o.
35 " United States.
35 " Edison, 30 K. W.
35 " Edison, self-oiler.
35 " Kester, self-oiler.
40 " Eickmeyer.
50 " Mather, M.P., self-oiler.
60 " Rockford, self-oiler.
60 " Edison, 45 K. W., self-oiler.

### 220-VOLT MOTORS.

¼ H. P. Diehl, self-oiler.
1 " Sprague.
1 " Sprague, self-oilers.
1 " Eddy, self-oilers.
1 " C & C, oil cup.
1 " C & C, s. o., new armature.
1 " Edison, ¾ K. W., self-oiler.
1 " Crocker-Wheeler, s. o., slow sp.
1 " Ahlm Edwards, new M.P., s. s.
1 " E. & C., M.P., s. o., new.
2 H. P. Eddy, self-oiler.
2 " Edison, self-oiler, 1½ K. W.
3 " Belding, M.P.
3 " C & C.
3 " Connecticut, self-oiler.
3 " General Electric type I. B., slow speed, new.
3 " T.-H., self-oiler.
3 " Card, slow speed, self-oiler.
4 " Edison, 3 K. W., self-oiler.
5 " Detroit.
5 " Akron, self-oiler.
5 " Akron, self-oiler, slow speed.
5 " Eddy, self-oilers.
5 " C & C, self-oilers.
5 " General Elec., M.P., s. o., s. s.
7½ " Eddy, self-oiler.
7½ " Edison, self-oiler, 6 K. W.
10 " Detroit, with extra armature.
10 " Sprague, self-oiler.
10 " Eddy, self-oiler.
15 " Westinghouse, letter type, s. o.
15 " Eddy, self-oilers.
15 " Edison, self-oilers, 12 K. W.
15 " Card, M.P., self-oiler, new.
18 " Edison, 15 K. W., self-oiler.
25 " C & C, s. o., new armature.
25 " Commercial, M.P., self-oiler.
25 " Edison, self-oiler, 20 K. W.
30 " Edison, self-oiler, 25 K. W.
35 " Crocker-Wheeler, M.P., s. o.
50 " Ft. Wayne Jenney.
50 " Thomson-Houston, D40.
50 " Westinghouse, self-oiler.
60 " Edison, 45 K. W., self-oiler.

### 500-VOLT MOTORS.

5 H. P. D. & D.
7½ " Commercial, self-oiler, new.
10 " Eddy, self-oilers.
12 " Lundell, self-oiler.
20 H. P. Triumph, self-oiler, Iron-clad.
20 " Card, self-oiler.
25 " T.-H., D20, self-oiler.
25 " Triumph.
30 " Rockford, self-oiler, new.
30 " Edison, 25 K. W., self-oiler.
35 " Jenney, self-oiler.
60 " Edison, 45 K. W., self-oilers.
75 " Sprague, s. o., new armature.
100 " Westinghouse, M.P., self-oiler.
135 " Commercial, M.P., self-oiler.

### ARC MOTORS.

3 H. P. 10 amp. Brush.

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SINGLE PHASE.

½ H. P. Stanley self-oiler, 100 volts, 16,000 alternations.
1 " Ft. Wayne, 100 volts, 125 cycle, self-oiler.
1 " Westinghouse, self-oiler, 100 v., 16,000 alternations.
2½ " Ft. Wayne, 100 volts, 16,000 alternations, self-oiler.
5 " Ft. Wayne, 100 volts, 16,000 alternations, self-oiler.

MULTIPHASE.

2 H. P. Stanley, 16,000 alternations, complete, with condenser, 500-volt. Transformers for same, 1000 or 2000-500.
3 " Westinghouse, 7200 alternations, any voltage.
10 " General Electric, type I, 8-10 900-110 volts, 60 cycle. Transformers for above extra.
20 " General Electric, type I, class 8-20-900, 222-volt.
10 K. W. type H transformers for above, 1070 or 520-220 volts, extra.

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2 30 K. W. Edison 120-volt.
2 25 K. W. Edison 120-volt.
40 K. W. 220-volt Commercial, direct connected.
25 K. W. 220-volt Commercial, direct connected.
1 D 50 125-Volt T. H.
1 35-H.P. 220-Volt Sprague Motor.
1 60 K. W. 500-Volt Edison Dynamo.
1 100 K. W. 220-Volt Elwell-Parker Shunt Dynamo, 500 Rev.

**ENGINES**
2 McIntosh & Seymour, 18½ x 18.
1 Erie Ball, 18x16.
2 Allis Corliss, 18x42.
2 Russell Automatic, 14x16.
1 Chandler-Taylor, 10x12.
1 Chandler-Taylor, 11x12.
2 Straightline, 10x16.
1 Taylor-Beck, 11x12.
1 Erie Ball, 12x12.
1 Erie Ball, 16x16.
1 McIntosh-Seymour Comb., 13x23x15.

**ALTERNATORS**
2 60 K. W. West Alternators, 1040-v.
2 45 K. W. West Alternators, 1040-v.
2 35 K. W. West Alternators, 1040 volts.
2 30 K. W. G. E. Alternators, 1040-v.
2 60 K. W. G. E. Alternators, 1040-v.
1 60 K. W. G. E. Alternator, 2080-v.
2 60 K. W. Slattery Alternators, 1040 v.
2 300 K. W. G. E. Alternators, 1040-v.
1 70 K. W. A-70 Alternator, 1040-v.
1 60 K. W. Warren Alternator, 1040-v.
1 150 K. W. West Alternator, 1040-v.

**RY. GENERATORS.**
1 H. I. T. H. 30 K.W., 500-v.
1 Edison 60 K. W., 500-v.
2 Edison 100 K. W., 500-v.
2 Edison 150 K. W., 500-v.
1 G. E. 200 K. W., 500-v.
1 West 250 K. W., 500-v.
1 Brush 175 K. W., 500-v.

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10 W. P. 50.
10 W. P. 30.
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| 3—75 | " | " | 1,000 50 100 | 37.50 " |
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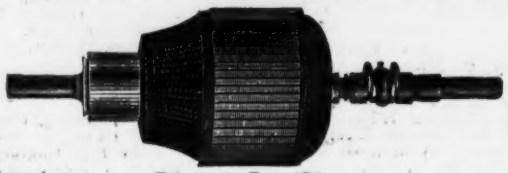

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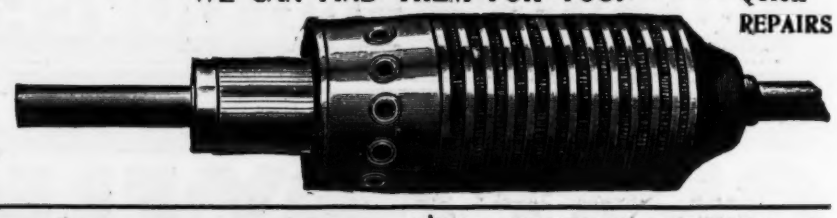

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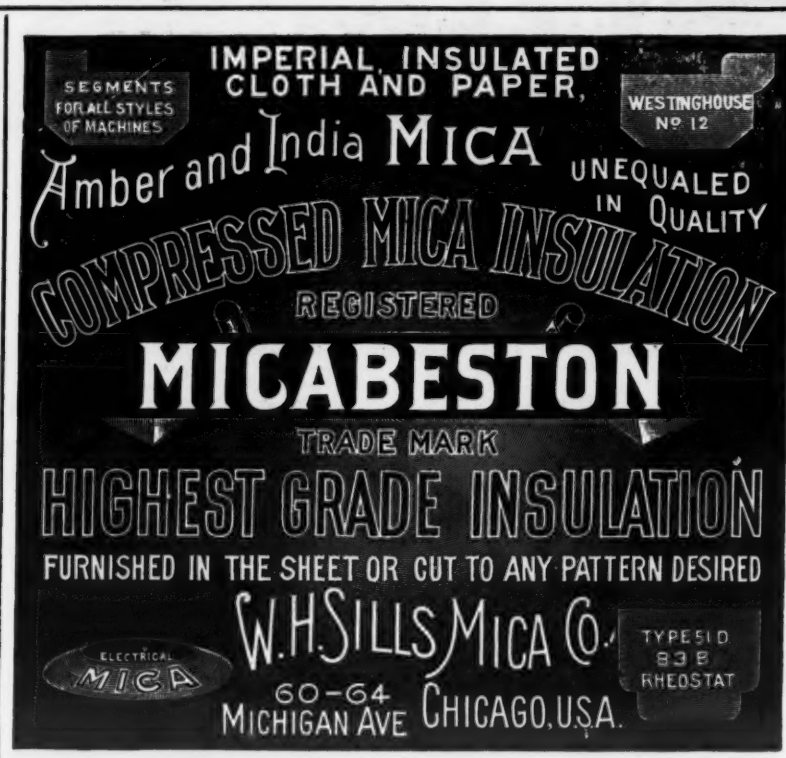


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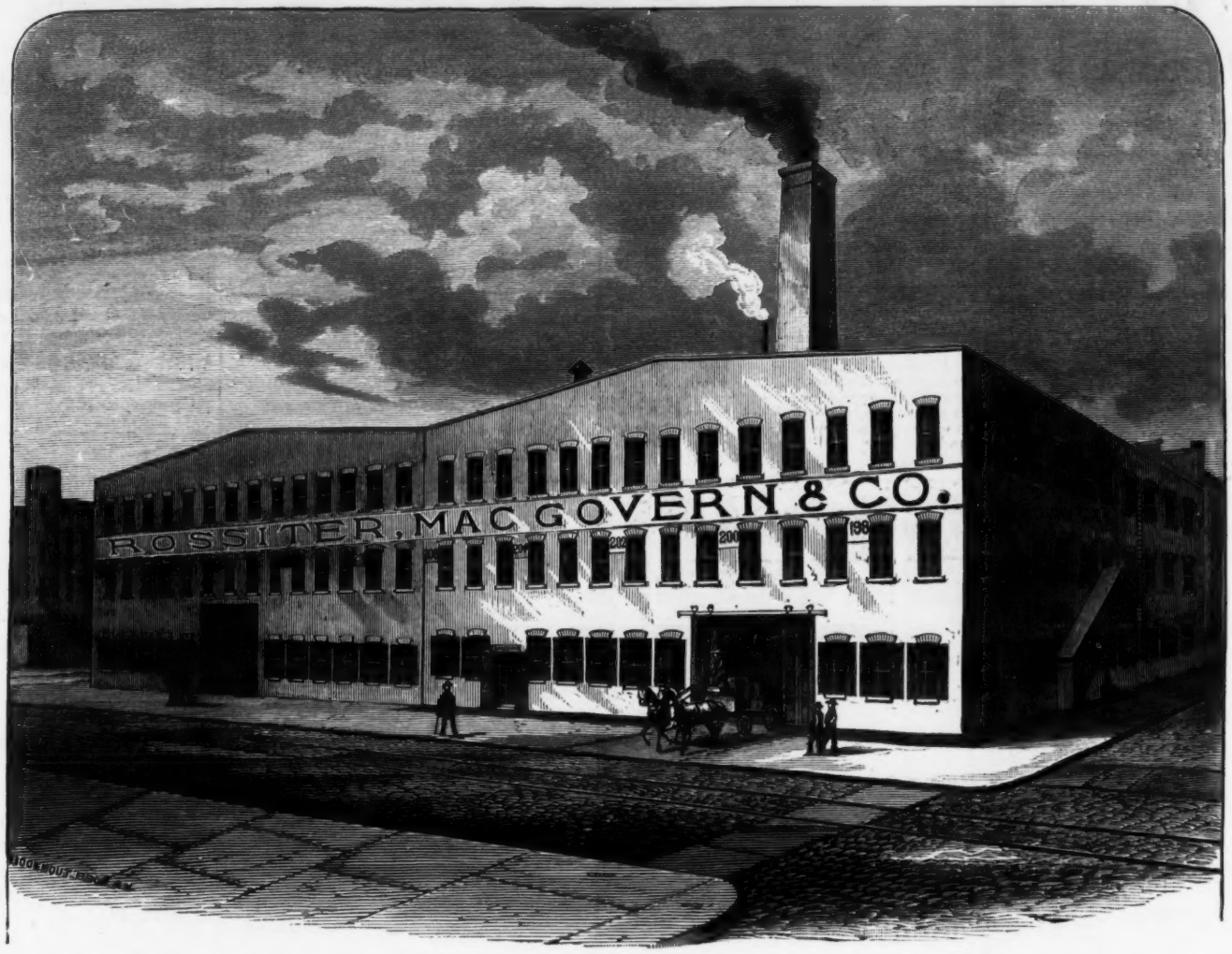


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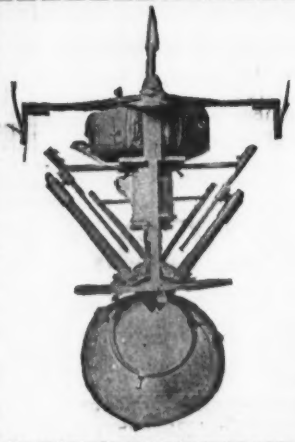

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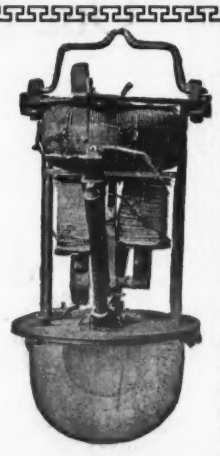

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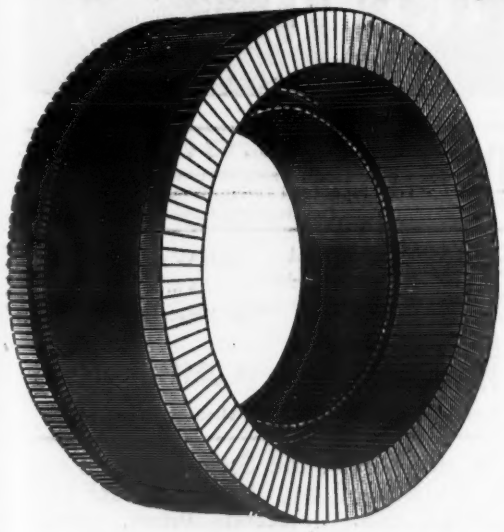

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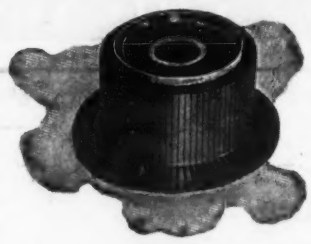

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